National Action Plan on Antimicrobial Resistance in the Slovak Republic

for the period 2019–2021

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ATB	antibiotic
CPE	carbapenemase-producing enterobacteria
CVMP	Committee for Veterinary Medicinal Products
EMA	European Medicines Agency
EPIS	Epidemiological Information System
ESVAC	European Surveillance of Veterinary Antimicrobial Consumption
EU	European Union
EUNTC	EU Network Training Centre
IPEVS	Institute of Postgraduate Education of Veterinary Surgeons
CVS SR	Chamber of Veterinary Surgeons of the Slovak Republic
MF SR	Ministry of Finance of the Slovak Republic
NGO	Non-governmental organisation
MRSA	Methicillin-resistant Staphylococcus aureus
CCATAP	Central commission for anti-infective therapy and antibiotic policy
ISCVBM	Institute of State Control of Veterinary Biologicals and Medicaments
PHA SR	Public Health Authority of the Slovak Republic
UVMP	University of Veterinary Medicine and Pharmacy
VRE	Vancomycin-resistant enterococci
VIS	Veterinary Information System
HI	Health insurers
HC	Health care
MRO	multi-resistant organisms
MH SR	Ministry of Health of the Slovak Republic
MI SR	Ministry of Interior of the Slovak Republic
NRCP	National Residue Control Plan
NHIC	National Health Information Centre
NRC	National Reference Centre
OIE	World Organization for Animal Health
VPD	vaccine-preventable diseases
PCU	Population Correction Unit
RATAP	Commission for rational anti-infective therapy and antibiotic policy
RPHA	Regional Public Health Authority
SMC	Slovak Medical Chamber
SMA	Slovak Medical Association
SR	Slovak Republic
PV	private veterinarian
SVFA SR	State Veterinary and Food Administration of the Slovak Republic
DVFA	District Veterinary and Food Administration

4.3 National Action Plan on Antimicrobial Resistance in the Slovak Republic

Current situation in human medicine in the Slovak Republic

With reference to the incidence of hospital-acquired infections (HAIs) in Slovakia, there is reason to believe that the incidence will be about the same as in other EU countries. Outpatient ATB use in Slovakia is slightly higher than in other EU countries. ATB use in healthcare facilities is around the EU level with ATBs prescriptions mainly being based on microbiological testing and susceptibility results. The use of antifungals to treat invasive fungal infections is below the European average. Slovakia is a country with disproportionately long prophylactic administration of ATBs for surgical interventions and significantly higher resistance of microorganisms to ATBs, especially in institutional healthcare facilities. In particular, the resistance of gram-negative microorganisms, enterobacteria, pseudomonads and acinetobacter to third and higher generation cephalosporins, fluorinated quinolone and aminoglycosides remains a major problem. There is a specific problem with the rapidly increasing resistance of enterobacteria to carbapenems. The resistance of gram-positive microorganisms is approximately on a par with other European countries but may worsen in the near future with the current implementation of preventive measures. The main causes of high ATB resistance are:

a) insufficient standards in hospital epidemiology and hygiene, including insufficient application of hygiene control in individual treatment units,
b) insufficient number of medical staff dedicated to the treatment of patients with multidrug-resistant infections,
c) insufficient number of single-bedded isolation rooms with their own sanitary facilities,
d) in recent times there have been disproportionate closures of infectious disease departments in healthcare facilities, which has made it harder to isolate patients with multidrug-resistant HAIs.

Slovakia has long had a relatively well-organised model of "antibiotic commissions" set up on the local level by healthcare providers. Their activities vary from one healthcare facility to another, however, and in some they do not operate at all. Many healthcare facilities do not have qualified specialists in hospital epidemiology and hygiene, infectious diseases, clinical pharmacology and the like. A large proportion of healthcare facilities do not have their own clinical microbiology department and cooperation between institutional healthcare facilities and external clinical microbiology departments does not always function as well as it could because overviews of resistance on the level of the treatment unit are not available everywhere. There is insufficient use of modern diagnostic methods based on the "genetic principle" – i.e. identifying resistance genes, using mass spectrophotometry and molecular epidemiology. The incidence of ATB resistance and ATB use are not adequately monitored in outpatient practice. The activity of antibiotic commissions on the level of self-governing regions is not performed or is ineffective. Given ATBs' low acquisition cost, control of their use is performed only sporadically. Testing of CRP levels is covered

only in paediatric practice. Slovakia was the first country in the EU to have a sepsis register. The project was terminated due to lack of funding. Other registers are insufficiently used, the only one currently in existence being a register of invasive fungal infections in haemato-oncological patients, which is not publicly funded. Slovakia is a country with low levels of inoculation against flu and pneumococcal diseases in the population, including health care workers. This leads to increased ATB use as a secondary effect. Anti-vaccine movements receive a disproportionately large space in the media. Slovakia makes little use of ICT to map the incidence of the most common pathogen strains in hospital-acquired infections, their resistance to ATB and the use of anti-infectives on the treatment unit level. The incidence of resistance and the use of anti-infectives are not adequately covered by existing information systems. Data on the use of anti-infective drugs is insufficiently verifiable both on the national level and at the level of individual healthcare providers. Paradoxically, while the incidence of HAIs is used as an indicator of the quality of healthcare provision, control for the incidence of HAIs, ATB use and other related factors are not.

Current situation in veterinary medicine in the Slovak Republic

Antibiotic resistance should be seen as a complex issue in the fields of human and veterinary medicine, animal health, food quality and food safety, not only in the territory of one country, but also from a European and global perspective.

For clarity, the following definitions from the One Health Action Plan are used in respect of antimicrobials and antimicrobial resistance:

Antimicrobials: include antibiotics, antivirals, antifungals and antiprotozoics.

Antimicrobial resistance: the ability of microorganisms, such as bacteria, to become increasingly resistant to antimicrobials to which they were previously susceptible.

The constant increase in antimicrobial resistance puts pressure on manufacturers of veterinary medicines to develop new, effective antimicrobial agents. The development of such new active substances and their testing for safety takes a long time.

Slovakia is a participant in European programmes aimed at controlling and reducing the use of antibiotics, e.g. the scheme to collect data on imports and sales of veterinary medicines in the European Surveillance of Veterinary Antimicrobial Consumption (ESVAC) since 2011, a pilot project to monitor the consumption of antimicrobial substances in pig holdings organized by the European Medicines Agency (EMA) in 2016, AMR monitoring since 2014 and monitoring programs for residues etc.

Compared to other EU Member States, Slovakia has average to lower antibiotic consumption based on ESVAC findings for distribution network sales in 2012, 2013 and 2014.

Despite the fact that sales per population correction unit (“PCU”) are satisfactory, the findings from monitoring resistance in the food chain based on checks at slaughterhouses and shops are less satisfactory.

Antibiotic use in Slovakia is controlled at the level of import, distribution, sale, prescription, use and application of veterinary medicines.

Slovakia participates in the harmonised monitoring of antimicrobial resistance on the EU level.

AMR monitoring in Slovakia began in 2014 and will continue until 2020. Monitoring of

antimicrobial resistance is conducted in accordance with Commission Implementing Decision No 2013/652/EU and includes isolates of the zoonotic agents Salmonella spp. and Campylobacter jejuni and indicator commensal E. coli isolates through which resistance genes can be transferred to other bacteria or pathogens.

It is conducted in two-year cycles that include combinations of bacterial species and sample types in animal populations and food categories. Monitoring covers the following species: pigs, poultry and cattle. Isolates are obtained from farm animals (poultry), slaughterhouses (poultry, pigs) and meat from the trade (poultry, pigs, cattle).

The results of European monitoring indicate significant incidence of antimicrobial resistance against tetracyclines, fluorinated quinolones, third and higher generation cephalosporins and aminoglycosides, in particular:

a) microorganisms resistant to antibiotics have been detected during treatment of animals on farms,
b) inadequate diagnosis of microorganisms' susceptibility to antibiotics during treatment,
c) possible contamination of meat in the slaughterhouse during animal slaughter, during the handling of meat in processing and packaging,
d) animal husbandry professionals' use of antibiotics without registration and without the knowledge of the veterinarian.

AMR monitoring will continue in 2021–2026 in a slightly modified format and will be expanded to include complementary molecular typing (WGS - Whole Genome Sequencing)

In Slovakia, microorganisms' susceptibility to antibiotics is tested by the Veterinary and Food Institutes in samples provided by private veterinarians providing health care on farms, in small animal clinics and small animal practices. At present the State Veterinary and Food Administration does not have statistical data on the number of such samples, their type, what animals they were taken from or the results of the susceptibility analyses or an evaluation of microorganisms resistance to the antibiotics used in a microbiological assay.

There is as yet no control of antimicrobial resistance and antibiotic use in veterinary outpatient practice or on livestock farms themselves based on outpatient records. Antibiotic consumption on pig farms was monitored in an ESVAC pilot project. This pilot project did not include monitoring of antimicrobial resistance.

One of the possible causes of the rise in AMR is frequent improper or incorrect use of antibiotics in veterinary medicine. The most frequent and most severe deficiencies are in prevention and the control of infections on farms. The emerging and current situation in respect of antimicrobial resistance requires the immediate implementation of systematic and effective measures not only on the regional and national levels but also on the European level.

Slovakia supports all activities aimed at reducing antimicrobial resistance as a global phenomenon that threatens animal and human health.

The objectives of the National Action Plan on Antimicrobial Resistance in the Slovak Republic are:

- monitoring of the occurrence and development of antimicrobial resistance,
- measures for the rationalisation of ATB use in healthcare facilities,
- improvements in hospital epidemiology and hygiene,

- education of health professionals and public information,
- use of ICT and E-Health in controlling HAIs and the rationalisation of anti-infective therapy
- joint activity of the MH SR and the MARD SR

The objectives of the veterinary action plan are broken down into activities:

- monitoring of the incidence and development of resistance in livestock farming,
- measures leading to rationalisation of antibiotic use in veterinary care,
- application of measures to reduce the use of antimicrobials in animals – improving the quality of hygiene, nutrition, animal health, animal vaccination, biological protection in farms and epidemiological evaluation of farms,
- education of veterinarians and the public on AMR,
- use of information technology in AMR control, the reporting of disease and the rationalisation of anti-infective therapy,
- joint activity of the MH SR and the MARD SR

4.3.1 Monitoring of the incidence and development of antimicrobial resistance

Human medicine

Up-to-date information on local resistance status is now a prerequisite for the effective use of ATBs in practice. This is especially true for the formulation of local recommendations for initial empirical antibiotic therapy. This requirement is particularly important in situations where resistance reaches a locally high level. Slovakia has relatively high levels of antibiotic resistance compared to other EU countries.

The surveillance of antibiotic resistance in Slovakia is coordinated by the NRC for monitoring of antibiotic resistance established at the PHA SR in 2001. The quality of the data on which surveillance is based is closely related to the main tasks of the NRC: methodological guidance, consultancy and implementation of an external quality control system for susceptibility testing in clinical microbiology laboratories in Slovakia. The NRC's activities also include more detailed molecular epidemiological analysis of significant resistance mechanisms, which is currently carried out at the necessary baseline level. The main technical resource for surveillance is the National Antibiotic Resistance Database. This is designed as an open system, which has been used to record and evaluate phenotypic data on antibiotic resistance obtained from field laboratory susceptibility tests since 2004. At present, it handles around 70% of the data from routine susceptibility testing of all clinically significant bacterial and fungal agents of infectious diseases. The database has been made accessible via an internet server (https://www.snars.sk/), which creates conditions for the wide availability of antibiotic susceptibility data for physicians prescribing antibiotics on a daily basis, for the activities of antibiotic policy management bodies at the level of healthcare facilities on the local and also national levels (antibiotic, nosocomial commissions, etc.). In addition to maintaining its own national database on antibiotic resistance, Slovakia supplies data on the antibiotic susceptibility of selected agents of infectious diseases to the European resistance database maintained by the ECDC EARS-Net project.

When the database was being set up, microbiological testing of biological materials was oriented towards local laboratories that

would analyse data for specific hospitals and their local catchment areas. The integration and merging of microbiology laboratories and the ways in which test materials are currently moved around interferes with the database's original aim of providing an analysis of antibiotic resistance on the local level. The data collection technology currently in use is losing compatibility with the increasing diversity of information systems in laboratories supplying antibiotic resistance data. As a result, data imports are late and partially incomplete, and the database is unable to meet requirements for timeliness and completeness. So far, the objective of providing data necessary for daily antibiotic prescriptions to as many doctors as possible is not being met because the database system's potential is still only being used in a minimal extent. Another shortcoming of the current monitoring system from the point of view of integrated surveillance of antibiotic resistance in Slovakia is the insufficient connection of the SNARS.sk database with veterinary data on identical infectious disease pathogens. The NRC has limited capacity to carry out more detailed epidemiological analyses of resistance mechanisms at the level of molecular biology. As regards antibiotic resistance monitoring, it is necessary to ensure the broad availability of high-quality, complete and up-to-date information on the status and development of antibiotic resistance in the country. Such information must be structured to support quick orientation and the decision-making capabilities of doctors prescribing antibiotics on a daily basis in practice and of the competent authorities in healthcare facilities, and on the regional and national levels (antibiotic, nosocomial commissions).

Proposed measures:

- ensure the quality of input data that routine laboratories supply for antibiotic resistance surveillance (national external quality control system, standardisation of testing methods),
- establish conditions for more targeted and detailed molecular analyses of important resistance mechanisms for epidemiological purposes.
- update the existing database system so that the data can be processed at short intervals and in a targeted manner (according to the sending doctor, hospital department or facility),
- provide support and methodological coordination for the development and use of other information systems in healthcare facilities to deliver up-to-date information on antibiotic resistance and the incidence of HAIs for use in local antibiotic policy management and anti-epidemic measures,
- promote the national antibiotic resistance database so that it is used by the widest possible group of doctors prescribing antibiotics in practice – the CCATAP, professional bodies, medical education.

Veterinary medicine

1. Targeted surveillance of antibiotic consumption and use

1.1 ESVAC – European Surveillance of Veterinary Antimicrobial Consumption

In 2010, with the support of the European Commission, the European Medicines Agency (EMA) launched the European Surveillance of Consumption of Veterinary Medicines project (ESVAC), which monitors data on imports and sales of antimicrobials in the veterinary field, thus indirectly

monitoring their consumption. The strategy of the EMA/CVMP is to promote and improve the availability of effective antimicrobial veterinary medicines, while at the same time taking targeted action to minimize the risks that their use presents for animals or humans by developing new guidelines for other groups of antibiotics, as well as guidelines for responsible cascade use and off label use (CVMP strategy on antimicrobials 2011–2015, 2016–2020).
Slovakia participated in reporting on antimicrobial consumption based on sales in 2011 and sends the results of data collection in this area to the Agency every year. The aim of the responsible authorities in Slovakia is to continue collecting such data and to cooperate with the EMA to improve the system for their collection and evaluation.

1.2 ESVAC – medicinal product use per animal species

In accordance with Regulation (EU) 2019/6 of the European Parliament and of the Council on veterinary medicinal products and repealing Directive 2001/82/EC, which requires Member States to implement a system for collecting data on the use of antimicrobials per animal species, Slovakia will collect the relevant data and then compare use per animal species with sales of the antimicrobials concerned. The aim will be to get a picture of the real use of antimicrobial medicinal products in livestock holdings and to combine and evaluate the situation and the results obtained with an assessment of livestock holdings considering biosecurity, welfare and animal hygiene conditions in the holdings concerned.

The data obtained from such projects should help in interpreting and identifying trends in AMR on the pan-European level, profiling and evaluating AMR risks, setting priorities for risk management, evaluating the effectiveness of control measures, defining and identifying critically important antibiotics and, not least, in comparing the use and effectiveness of antimicrobial medicinal products in human and veterinary medicine and between Member States. This data is intended to form a base for targeted research and development.
A basic condition for project implementation is new legislation on veterinary medicinal products that permits the EMA to authorise project and gives Member States a mandate for their support and financing through the competent ministries as well as for their direct implementation and application in practice.
Proposed measures:

- continued collection of data on medicine use based on the sale of veterinary medicinal products through wholesale distributors – Institute of State Control of Veterinary Biologicals and Medicaments, Nitra (ISCVBM),
- collection of data on the consumption of antibiotics per animal species on the farm level to determine real levels of antibiotic use in animals producing food for human consumption.
- provision of funding from the state budget for programmes collecting data on AMR and antimicrobial medicinal products.

2. The purpose of AMR monitoring is to know the level and distribution of bacterial resistance to antimicrobials. Slovakia participates in the harmonised monitoring of antimicrobial resistance on the EU level. AMR monitoring in Slovakia began in 2014 and will continue until 2020. It is conducted in two-year cycles that include combinations of bacterial species and sample types in animal populations and food categories.

Monitoring of antimicrobial resistance is conducted

in accordance with Commission Implementing Decision No 2013/652/EU and includes isolates of the zoonotic agents Salmonella spp. and Campylobacter jejuni and indicator commensal E. coli isolates through which resistance genes can be transferred to other bacteria or pathogens. The monitored agents include E. coli that produce extended spectrum β-lactamases (ESBLs), and AmpC β-lactamases (AmpC), monitored since 2015, and carbapenemases, monitored since 2019, which are used to track resistance to β-lactam antibiotics, especially cephalosporins and carbapenems, which are used as last-line antibiotics in human medicine to treat infections caused by multi-resistant strains (meropenem, ertapenem, impenem). Isolates are obtained from healthy animals at farms (poultry) or at slaughterhouses (poultry, pigs) and from meat in shops (poultry, pigs, cattle). Monitoring date is gathered, evaluated and sent to the European Food Safety Authority in accordance with Commission Implementing Decision No 2013/652/EU. AMR monitoring will continue in a modified form until 2026.

Proposed measures:

- systematic collection and evaluation of AMR data from food-producing species and food to determine the current situation in antimicrobial resistance and then adopt measures to reduce it and the expansion of the programme to include results based on clinical specimens and non-food animals, e.g. companion animals.
- extend the EU programme for the monitoring of antimicrobial resistance at the national level so that it is carried out annually in poultry, pigs and cattle and to extend the taking of bovine samples to animals,
- secure funds from the state budget and through projects for national monitoring of AMR at farms, slaughterhouses and in the sales network in order to determine the level and extent of antimicrobial resistance in bacteria for the duration of the action plan,
- through cooperation with the Chamber of Veterinary Surgeons, involve private veterinarians in the collection of samples from livestock and the targeted testing of susceptibility in samples taken from livestock, and gradually involve veterinary practices and clinics for companion animals in the system and plan.
- secure funds from the state budget and through projects for the national AMR monitoring for private veterinarians and the SVFA SR for the targeted collection of samples and information on antimicrobial use in livestock holdings (pigs, poultry and cattle) to monitor pathogen susceptibility and antimicrobial resistance.
- publish the results of AMR monitoring on the portal of the SVFA SR,
- monitor the practical use of critically important antibiotics in food animal husbandry.

In Slovakia, the supervision of antimicrobials and control of their prescription, registration, storage and use in food animal husbandry is regulated by Act No 362/2011 on medicinal products and medical devices and amending certain acts, as amended ("Act No 362/2011"), which implements Directive 2001/82/EC of the European Parliament and of the Council on the Community code relating to veterinary medicinal products. Controlling the circulation and use of antimicrobial agents is an important tool in combating antimicrobial resistance.

In Slovakia, veterinary medicinal products containing antimicrobial substances may be supplied to people who keep food producing, companion and exotic animals only by the holder of a wholesale distribution licence for veterinary medicinal products, a public pharmacy based on veterinary prescription or a veterinarian performing veterinary activities who is responsible for the animals' treatment.

Medicated feeds containing antimicrobial substances may be supplied to people who keep food producing, companion and exotic animals only by a medicated feed manufacturer or a medicated feed wholesale distributor based on a prescription for medicated animal feed prescription. Act No 362/2011 prohibits the sale of veterinary medicinal products via the internet. Medicated feeds administered to livestock for the prevention and treatment of disease are a cause of the increase in AMR because sick animals have a lower feed to water intake ratio. Lower doses of medicated feed, and thus also the veterinary medicinal product cause underdosing of medicine so that it does not reach its threshold dose and resistance increases.

All Member States have legislation to strengthen the control system for antimicrobials in primary food production. Measures to control residues and monitor the presence of residues of pharmacologically active substances include monitoring programmes such as the National plan for control of residues in in live animals and animal products ("NRCP") and the EU-wide prohibition of the use of all antibiotics to promote animal growth in effect since 2006.

- Strict adherence to standards and guidelines of the World Organization for Animal Health ("OIE") on the responsible use of antimicrobials and the use of critically important antibiotics for human medicine in the veterinary treatment of food animals on farms
- Consistent monitoring of records of antimicrobials administered by keepers or owners of food animals pursuant to Act no. 362/2011 and presentation of documentation of antimicrobials' purchase, storage and administration to food animals at the request of the District Veterinary and Food Administration.
- Enforce a duty for veterinarians to keep records of preventative activities and interventions carried out, and of the prescription, use and issuing of veterinary medicinal products; such records must be kept for at least five years and be made available to the competent veterinary authorities,
- Agree with selected volunteer PVs that they will provide quarterly reports to their District veterinary and food administration on the use of veterinary medicinal products in food animals based on their outpatient records of administered veterinary medicinal products containing antimicrobials.
- It is recommended that certain pathogens be monitored in the following food animal species on farms:
    - cattle
    - calves: *E. coli, Salmonella spp., Pasteurella spp*.
    - lactating dairy cows: *E. coli, Staphylococcus spp., Streptococcus spp.*
    - pigs: *E. coli, Salmonella spp., Streptococcus spp., Actinobacillus pleuropneumoniae, MRSA*
    - poultry: *E. coli, Staphylococcus spp., Streptococcus spp.*
- Consistent use of antibiotics in accordance with the guidelines of the Committee for Veterinary Medicinal Products

("CVMP") incorporated into the summaries of product characteristics for veterinary medicinal products as regards the diagnosis of infectious animal diseases and monitoring of the results of antibiograms and the subsequent responsible treatment of animals

- Control of the adopted measures: the competent bodies of the SVFA SR will conduct an annual review of compliance in the use and control of antibiotics and antimicrobial resistance in food animals by animal husbandry professionals and veterinarians.

4. Monitoring of antimicrobial residues in products of animal origin

It is extremely important to monitor antibiotic residues in products and raw materials of animal origin to prevent them from entering the food chain and to prevent the possible development of antimicrobial resistance.

Proposed measures:

- if an attending private veterinarian has used a medicine in a special case under Section 106 of Act No 362/2011 of 13 September 2011 on medicinal products and medical devices and amending certain acts, as amended, the withdrawal period stipulated in the act must be complied with to prevent the occurrence of residues in products of animal origin. The findings and evaluations in such cases can be used to determine which antibiotics cannot be used in special cases (cascade system and off label use) and thus to prevent the development of antimicrobial resistance.
- Another achievable target in the monitoring of antimicrobial residues is to detect adverse effects of antibiotics that may occur in cases where the withdrawal period specified by the package leaflet is applied but antibiotic residues are nevertheless found at levels exceeding the maximum residue limit. In the event of such findings, the attending private veterinarian is required to report the adverse effect of the medicinal product in question to the ISCVBM in Nitra.
- another objective in monitoring is to determine whether the animals in livestock holdings where residues have been detected have resistance to the antibiotics in question, to determine whether there is resistance to the antibiotics concerned in those holdings where residues were found in animals,
- if it is suspected that an antibiotic is not sufficiently effective and the medicinal product was administered in accordance with the package leaflet, this suspicion must be reported to the ISCVBM in Nitra as an adverse effect.
- the residue control plan should focus on new antibiotic active substances or new combinations of antibiotic substances.

4.3.2 Measures for the rationalisation of ATB use in healthcare facilities

Human medicine

The aim of the activities of antibiotic commissions in institutional healthcare facilities (Commission for rational anti-infective therapy and antibiotic policy, RATAP) is to rationalise the use of anti-infective drugs to be administered for a documented or highly probable bacterial infection. The RATAP Commission is an advisory body to the hospital management and, together with the HAI Commission (with which it may be combined into a single commission), a powerful hospital management tool to achieve rational ATB use, optimise the epidemiological situation and optimise economic costs for HAIs and anti-infective use. The RATAP Commission uses modern

tools to rationalise the prescription of anti-infective drugs and control their consumption.

Anti-infective drugs in institutional medical facilities can be divided into anti-infective drugs whose use does not require consultation with a specialist in anti-infective therapy and anti-infective drugs whose use requires consultation with a specialist in anti-infective therapy (a member of the antibiotic commission). In urgent cases (treatment escalation, treatment of neutropenic patients), they may be prescribed without consulting a member of the antibiotic commission. Their use must be reviewed at regular intervals in relation to the epidemiological situation and in relation to their consumption in the institutional health facility.

Anti-infective drugs whose use requires consultation with a specialist in anti-infective therapy must only be used to treat documented or highly probable infections with the following bacteria:

- multidrug resistant, methicillin resistant staphylococcal infections
- vancomycin resistant enterococcal infections
- multi-resistant penicillin resistant pneumococcal infections
- multi-resistant enterobacterial infections resistant to carbapenems, third and higher generation cephalosporins, aminoglycosides and fluorinated quinolone
- multi-resistant pseudomona and acinetobacter infections resistant to carbapenems, third and higher generation cephalosporins, aminoglycosides and fluorinated quinolone
- multi-resistant anaerobic infections
- *C. difficile* infection
- candida bloodstream infections
- infections caused by filamentous fungi

The anti-infective drugs whose use requires consultation with a specialist in anti-infective therapy are:

- carbapenems
- post third generation cephalosporins, anti-pseudomonad cephalosporins
- anti-pseudomonad aminoglycosides
- anti-pseudomonad penicillin
- anti-pneumococcal quinolones
- antibiotics for the treatment of methicillin resistant staphylococci - glycopeptides (including novel glycopeptides), oxazolidinones, glycylcyclines
- new anti-infectives for the treatment of *C. difficile*
- antifungals from the group of novel triazoles and echinocandins
- newly introduced antifungals

Tools for the optimisation of anti-infective therapy in institutional healthcare facilities:

- close cooperation of the Antibiotic Commission, the HAI Commission and the management of the institutional healthcare facility, clinics and departments,
- education of all groups of healthcare professionals, including the management of the institutional healthcare facility,
- use of ICT technologies in the control of HAIs, the prescription of anti-infectives and control of their consumption,
- use of ICT technologies to map resistance in individual treatment units,
- monitoring drug levels to achieve an optimal therapeutic regimen,
- introduction of internal hospital standards for the diagnosis and

treatment of the most common community and hospital acquired infections,
- introduction of internal hospital standards for the comprehensive management of sepsis, infections in immunocompromised patients and invasive fungal infections,
- introduction of internal hospital standards for preventive antibiotic administration in surgery and invasive procedures,
- introduction of internal hospital standards for pre-emptive screening to identify colonised patients,
- the introduction of internal hospital standards for the vaccination of hospitalised patients and healthcare professionals.

Over the next few years, healthcare establishments should establish the following ICT-based registers:

- register of patients colonised by multidrug-resistant microorganisms in the past
- register of HAIs and multidrug resistant microorganisms,
- register of sepsis cases,
- register of invasive fungal infections,
- register of ATB consumption in individual treatment units (in relation to resistance),
- register of compliance with procedures for the comprehensive management of the most common infections
- register of vaccinations of patients and healthcare professionals.

Institutional healthcare facilities will create, either on their own or in cooperation with other healthcare facilities, their own method for monitoring the optimisation of anti-infective therapy. A system of one-day prevalence studies is considered one of the best practices.

Implementing ICT technologies will allow:

- notification of patients with multi-drug-resistant infections, including monitoring of the spread of multi-drug-resistant microorganisms (optimal spread of genes of bacteria responsible for multidrug resistance),
- notification of patients colonised with multidrug-resistant microorganisms, including monitoring of the spread of multidrug-resistant micro-organisms (optimal spread of genes of bacteria responsible for multidrug resistance),
- electronic assistance for the comprehensive management of the most frequent hospital-acquired infections, including procedures for hospital epidemiology and hygiene.
- notification of significant differences in the prescription of anti-infectives,
- electronic assistance in prescribing anti-infectives considering the MIC (minimum inhibitory concentration of ATB), the pharmacokinetics and pharmacodynamics of anti-infectives, simulation of the potential efficacy of anti-infectives with subsequent dose adjustment,
- mapping of the most common pathogens and their resistance at the level of individual treatment units,
- monitoring of the spread of bacterial colonisation in individual treatment units,
- use of smart bracelets when transporting patients between departments of an institutional healthcare

facility and between healthcare facilities.

Monitoring drug levels requires:

- an increase in the number of institutional healthcare facilities where patients have access to therapeutic monitoring of anti-infective levels,
- monitoring of vancomycin and glycopeptide levels should gradually be made mandatory,
- implementation of the monitoring of levels of triazole antifungals and other groups of anti-infectives, especially in children, patients with sepsis, disorders of the kidney or liver and patients expected to have unpredictable drug pharmacokinetics and pharmacodynamics,
- implementation of the routine use of tools for notifying interactions between anti-infectives and other drugs.

Sepsis management requires:

- active identification of patients with sepsis using the criteria of the "Campaign to reduce sepsis and septic shock (SSC)" among vulnerable patients in intermediate care units,
- electronic assistance in fulfilling individual sepsis management packages
- improvements in the survival of patients with severe sepsis in the long term.

Screening for patients colonised with multidrug-resistant microorganisms before planned operations and screening of healthcare professionals requires the preparation of standards for individual types of surgical procedures and the eradication of multidrug-resistant microorganisms predominantly without the use of anti-infectives (effective local disinfection, phage treatment).

Preventive administration of ATB in surgery for invasive procedures requires:

- regular updating of the standards for individual procedures based on monitoring of the spread of colonisation at the level of individual treatment units,
- regular review of the effectiveness of the prophylactic administration of anti-infectives, with the option of ICT assistance in proposing the rotation of prophylactic procedures,
- maintaining the duration of the prophylactic administration of anti-infectives in one dose / 24 hours for all indicated groups of patients / surgical procedures.

If an institutional healthcare facility does not have an infectious disease department and a microbiology department, the activities of the antibiotic commission should be performed by an infectious disease specialist with experience in anti-infective therapy.

The quality of the activities of the antibiotic commission, hospital epidemiology and hygiene (standardisation of activities in this area) must be included in the basic indicators of the quality of activities of healthcare facilities. The implemented procedures should be included in the DRG (diagnostic related groups) catalogue. The activity report must be made available in the hospital's information system.

Antibiotic commissions for the prescription of anti-infectives in the community currently operate on the level of the self-governing regions. Their activity is symbolic, which in recent years, despite repeated

warnings, has led to a decline in their activity. The following reforms of their activities are proposed:

- the health insurers should provide funding for the activity of the commission, programmes promoting rational use of anti-infectives and educational programmes for healthcare professionals and the public,
- the commission should include regional specialists on infectious diseases, clinical microbiology, general medicine, paediatrics and specialists from departments that are major users of anti-infectives (ear-nose-throat, pulmonology, surgical departments, gynaecology and obstetrics, internal medicine and other specialisations).

The duties of the antibiotic commission relating to prescribing anti-infectives in the community are:

- to map the most common infection pathogens in the community and their resistance to anti-infectives (in stages down to the level of individual healthcare providers),
- to map the use of anti-infectives (in stages down to the level of individual healthcare providers and the level of individual infections),
- to map patients colonised with multidrug-resistant microorganisms (gradual development of a register),
- to map the most common pathogens in the community and their resistance to anti-infectives, to map use of anti-infectives; data on patients colonised with multidrug-resistant microorganisms should be incorporated into the information system for first-contact doctors and specialist doctors.
- to organise, in cooperation with educational institutions and professional bodies, educational events for healthcare professionals,
- to organise, in cooperation with educational institutions and professional bodies, educational events for the public,
- to organise for "Antibiotics Awareness Day",
- to prepare recommendations and procedures for the use of antibiotics in the community if needed,
- to evaluate the adopted measures and produce an annual activity report

Proposed measures:

- to perform checks of the activity of antibiotic commissions in institutional healthcare facilities,
- to conduct discussions with doctors in the self-governing regions to establish or revive antibiotic commissions,
- to hold discussions with health insurance payers on support for the AMR Action Plan
- to produce management standards for the most common infectious diseases for which ATBs are prescribed.

Veterinary medicine

Measures for the rationalisation of antibiotic use on livestock farms and in veterinary clinics

In Slovakia, veterinary medicinal products, including antimicrobials, can only be administered to food animals on farms by the veterinarian responsible for the animals' treatment and animal husbandry professionals, if they have been instructed by the

veterinarian responsible for the animals' treatment on the diagnosis, the method of administration, dosage, duration of treatment, the target species, contraindications, adverse effects and the withdrawal period of the administered antimicrobial, if there is no risk for consumers from residues in foods of animal origin obtained from the treated food animals and if they have documented authorisation to administer the antimicrobial given in advance by the veterinarian responsible for the animals' treatment. An antimicrobial administered by injection may only be administered to an animal by the veterinarian responsible for the animal's treatment. While medicated feeds made from veterinary medicinal products as premixes are still in use in veterinary practice, responsible use of veterinary medicinal products requires full respect for Regulation (EU) 2019/4 of the European Parliament and of the Council on the manufacture, placing on the market and use of medicated feed, amending Regulation (EC) No 183/2005 of the European Parliament and of the Council and repealing Council Directive 90/167/EEC.

Under Section 104 of Act No 362/2011, a veterinarian responsible for the treatment of animals must record every use of antimicrobials on a farm with food animals and animal husbandry professionals must keep records of all veterinary medicinal products administered under authorisation from the veterinarian responsible for the animals' treatment.

The veterinarian responsible for the animals' treatment is responsible for the qualified, appropriate use of the antimicrobials that they prescribe or administer on a farm with food animals in accordance with the summary of product characteristics. If an animal husbandry professional administers an antimicrobial to a food animal on a farm under authorisation from the veterinarian responsible for the animal's treatment, they are responsible for compliance with the attending veterinarian's instructions, of which a record must be kept. In Slovakia, veterinary pharmaceutical supervision on food animal farms and checks of the private veterinarians responsible for animals' treatment on these farms is performed by the veterinary inspectors of the District veterinary and food authorities.

Proposed measures

Veterinarians:

- use antimicrobials primarily as indicated in the summary of product characteristics, the package leaflet and on the label,
- use antimicrobials with caution for targeted treatment in accordance with the clinical diagnosis and, if possible, considering the results of antimicrobial susceptibility testing and primarily using antimicrobials with the narrowest possible spectrum,
- prescribe and issue antimicrobials based on a justified veterinary diagnosis in line with the current state of scientific knowledge,
- use metaphylactic administration of antimicrobials to a group of healthy but probably infected animals in mutual contact with the aim of preventing the development of clinical symptoms in the group and the further spreading of disease only if such treatment is really justified and only in isolated cases,
- limit the prophylactic administration of antibiotics to critical situations where animal health is endangered and after careful consideration of the situation in the herd over the term of the action plan with a follow-up review of outcomes,

- consider all information on infected animals, the causes and nature of the infection and range of antimicrobials available when deciding on antimicrobial treatment,
- prioritise narrow-spectrum antimicrobials except in cases where previous susceptibility testing indicates that such antimicrobials would be ineffective. Veterinarians should avoid using broad-spectrum antimicrobials and combined antimicrobials (other than fixed combinations that are authorised veterinary medicinal products).
- use of antimicrobials that are critical for human medicine only when no other alternatives are available,
- prioritise, wherever possible, individual treatment of affected animals over group or mass treatment,
- continuously monitor and record the quantity of antimicrobials administered in feeds or water, especially in intensive livestock holdings,
- pursue the ultimate goal of primarily reducing the use of antimicrobials in the group of antimicrobials classified as critically important antibiotics through prophylactic measures such as biosecurity, better animal hygiene for livestock and not least by ensuring welfare conditions,
- limit as much as possible the use of critically important antibiotics in metaphylactic treatment of livestock holdings through the use of regular antibiograms of livestock,
- focus more on the vaccination of animals, if vaccination is available, and any alternative treatments that are available such as probiotics, prebiotics and acidifying preparations,
- focus on livestock holdings where there are multidrug resistant enterobacterial infections resistant to third and higher generation cephalosporins, fluoroquinolones, aminoglycosides, tetracyclines and penicillins and take appropriate measures there by using antibiotics to which susceptibility has been confirmed by an antibiogram.
- focus on increasing national production of raw materials of animal origin owing to the risk of importing unknown bacteria with genetically encoded antimicrobial resistance and the risk to public health.

Farms

Cautious use of antimicrobials should be a common practice on food animal farms and should lead to more rational and targeted use that maximises therapeutic effects while ultimately leading to an overall reduction in antimicrobial use.

Proposed measures:

- focus official checks of livestock farms on the cautious and correct use of antimicrobials. The aim of such checks is to verify that the antimicrobial drugs used on farms are used cautiously and responsibly and, in this way, ensure that antimicrobial resistance is prevented.
- during checks, DVFA inspectors in Slovakia can provide correct guidance to the veterinarian or animal husbandry professionals on the cautious use of antimicrobials,
- limit the use of antimicrobials on food animal farms outside the authorized veterinary medicinal product authorisation (cascade and off label use) to the minimum necessary and allow it only in exceptional cases where no other authorized treatment options are available,

- the veterinarian and the animal husbandry professional concerned should prepare a joint plan for the rational use of medicated feeds on a farm and wherever possible should replace it with effective therapies such as injections and water-soluble powders and solutions,
- the prescribing veterinarian responsible for animals' treatment should base decision on the treatment of food animals on a farm independently, avoiding conflicts of interest, and should have guaranteed independence in decision-making based primarily on expertise,
- close monitoring of the summaries of product characteristics of veterinary medicinal products as regards the effects of antibiotics on veterinary practice and on the environment and their direct implementation on farms and pastures in livestock farming,
- to protect the farm environment and to protect the soil and water against contamination with antimicrobials, ensure the adoption of Communication from the Commission to the European Parliament, the Council and the European Economic and Social Committee European Union Strategic Approach to Pharmaceuticals in the Environment COM/2019/128 final, to which Slovakia subscribes. In the coming years, it will be necessary to monitor progress in this area and to implement these provisions in veterinary and agricultural practice when the guidelines are issued.
- the primary duty of animal husbandry professionals is to pay careful attention to hygiene in livestock housing, to carry out regular disinfection, insect control and to maintain biosecurity,
- the basic prerequisite for animal health is good animal nutrition using high-quality, wholefood feeds. Animal husbandry professionals must ensure the correct housing, treatment and appropriate nutrition for each livestock species.

Control of adopted measures: a joint meeting of the Chamber of Veterinary Surgeons (CVS SR) and the SVFA SR will evaluate the results of the adopted measures once per year.

4.3.3 Improvements in hospital epidemiology and hygiene Coordination of activities of hospital antibiotic and hospital-acquired infection commissions.

Human medicine

In Slovakia, hospital epidemiology is regulated by the following legislation:

- Section 52(5) of Act No 355/2007 – obligations of healthcare providers (to prevent hospital-acquired infections, to record the incidence of hospital-acquired infections in health documentation, to conduct analyses of their incidence and the causes of their occurrence and to adopt measures to reduce their incidence and prevent their spread, and to provide systematic training for staff on preventing hospital-acquired infections),
- Implementing Decree of the MH SR No 533/2007 on requirements for the operation of healthcare facilities regarding health protection elaborates in detail on obligations laid down in Act No 355/2007,
- Implementing Decision of the MH SR No 09812/2008-OL of 10 September 2008 on minimum requirements for personnel and material-technical equipment in each type of healthcare facility: "An institutional facility must employ an epidemiologist to monitor, analyse and prevent hospital-acquired infections".

Proposed measures:

Under current legislation, the employment of staff for hospital epidemiology and hygiene is a competence of hospital management and is not obligatory. The prevention and control of HAIs in healthcare facilities requires implementation of the following proposals:

- a general hospital must employ a full-time doctor for every 500 beds and a public health officer for every 250 beds,
- a specialised hospital must employ a full-time doctor for every 250 beds and a public health officer for every 250 beds.

Patient isolation:

- it is necessary to increase the number of single rooms with their own hygiene facilities from below 5 to over 10% within at most 5 years.
- whenever building modifications are made in inpatient healthcare facilities and in subsequent proceedings for approval of operating rules by the competent RPHA, the healthcare provider must be required to create at least one single room with its own hygiene facilities that will not be furnished as a superior-standard room but as a room for isolating patients infected/colonised with MDR strains when necessary,
- amend legislation so that for every 20 ward beds, every inpatient department is required to have at least one single room with its own hygiene facilities.

Hand hygiene:

- create a national hand hygiene programme based on the WHO campaign and implement a single hand hygiene programme as a mandatory document for all inpatient healthcare facilities in Slovakia. The RPHA in Trenčín is currently preparing and coordinating the campaign to ensure a high standard of quality and expertise, but it will not achieve the desired effect unless healthcare facilities have an adequate staff of epidemiologists,
- implement obligatory monitoring of compliance with healthcare professionals' compliance with hand hygiene and the consumption of alcohol-based disinfectant in litres per bed day,
- implement compulsory hand hygiene training with well-defined content and follow-up testing of knowledge,
- implement statistical reporting to Commissions for ATB resistance / Commissions for HAIs on compliance with hand hygiene and the use of alcohol-based disinfectant by healthcare professionals.

Innovations in the HAI surveillance system:

- conduct periodic (quarterly / yearly) reviews of the indicators of healthcare quality in the area of hospital epidemiology and hygiene using appropriate denominators,
- using the hospital information systems of institutional healthcare facilities, implement monitors of quality indicators for HAIs using appropriate denominators that reflect exposure to specific risk factors, i.e. incidence per number of days of exposure to an invasive device / procedure
    - ✓ number of UTIs / number of catheter days (PMK)

  - ✓ number of BSIs / number of catheter days (CVK)
  - ✓ number of RTIs / number of patient days on ventilator (UPV)
  - ✓ number of SSIs / number of patients operated per type of surgery (abdominal surgery (COLO), cholecystectomy (CHOL), hip replacement (HPRO), knee replacement (KPRO), laminectomy (LAM), caesarean section (CSEC), thoracic surgery (CABG))
- work to link reporting via hospital information systems to EPIS and reduce administrative load while increasing the quality of reporting,
- in addition to using the International Classification of Diseases code, report HAI diagnoses using the ECDC's standard codes for HAI, which need to be adjusted to the available diagnostic range for each infection type in Slovakia,
- conduct checks of HAI reports via the microbiological information systems of microbiology laboratories.

Decontamination of instruments and medical devices:

- amend legislation on monitoring the effectiveness of decontamination of instruments and medical devices with chemical indicators,
- introduce compulsory automation of decontamination processes for instruments and medical devices classified as category 2 endoscopic devices and checking of processes performed using indicators in line with current European recommendations.

Environmental decontamination – standardised monitoring of the hygienic quality of the hospital environment:

- improve the quality of cleaning and decontamination of the environment by effective control – specifically by obligatory monitoring of cleaning performance using UV florescence and monitoring of decontamination effect using ATP luminometry, especially in clean rooms,
- optimise the performance of microbiological control in line with international recommendations and implement testing for ATB resistance using rapid methods in diagnostics in the environmental microbiology laboratories of RPHAs in Slovakia,
- introduce mandatory testing for resistance in environmental isolates in the event of suspicion of strains with clinically and epidemiologically relevant resistance mechanisms (VRE, MRSA, CPE)
- prepare a uniform methodology for the collection of swabs from the environment, the elimination of common surfaces and focus on frequently touched surfaces,
- create a system for certifying firms providing cleaning services for healthcare facilities for a specified period.

Antibiotic policy:

- coordinate the activities of the ATB resistance monitoring commission and the HAI Commission – create a single Commission for rational anti-infective pharmacotherapy, antibiotic policy and hospital-acquired in-

fections (RATAP-HAI) and uniform standards for commission staffing,
- determine indicators for monitoring the incidence of ATB resistance and HAIs reported to the commission.

Development of "groups of measures" for the prevention of the most common types of HAIs:

- development of standard preventive procedures in line with the current knowledge from evidence-based medicine (EBM) relating to care for patients:
  - ✓ with a permanent urinary catheter,
  - ✓ with a central venous catheter, a dialysis catheter,
  - ✓ on artificial respiration,
  - ✓ with a finding of *Clostridium difficile* in stool,

Coordination of activities for the prevention of ATB resistance and prevention of HAI occurrence by the national authority:

- establish a National Reference Centre for HAIs to implement methodologies and coordinate activities for the prevention of HAIs.

Veterinary medicine

Application of measures to reduce the use of antimicrobials in animals (improvements in quality, hygiene, nutrition, animal health, animal vaccination, biosecurity of livestock holdings and epidemiological evaluation of livestock holdings).

Animal health and protection (biosecurity)

Improved measures for animal health, welfare and biosecurity and support for good agricultural practices can prevent infections and thus contribute to decreased use of antimicrobials in animals ("prevention is better than the cure") and therefore to a reduction in the risk of AMR developing in animal pathogens and zoonotic agents. Good living conditions for animals and biosecurity measures for livestock holdings can contribute to the objective of reducing the use of antimicrobials in animal husbandry. It is important to improve animals' living conditions through organisational measures designed to reduce negative environmental impacts, improve animal health, reduce the need for veterinary interventions and minimise drug use.

At present EU and Slovak national law set minimum standards for the protection of livestock, calves, pigs, laying hens and broilers; Slovakia also offers funding (in the form of subsidies) for farmers who commit to providing a higher standard of conditions for animals than the minimum requirements. Animal health and good living conditions are related in that when living conditions are good there is a greater chance that animals will be and will remain healthy, which also has economic benefits for farmers. Good farming/production practices, staff competence, the provision of good quality and balanced feedstuffs, appropriate water and hygiene conditions for the livestock holding, checking and timely treatment of animals – including the provision of urgent medical care if necessary – certainly contribute to the desired overall picture of a farm. The level of hygiene in a livestock holding directly reflects farmers' professional maturity and higher levels of animal hygiene also improve production. Bioclimate is an important part of livestock farming whose key elements are temperature stability, relative humidity and reducing the concentration of harmful gases in animal housing. The health and economic value of farms is also affected by the inci-

dence of infectious agents, especially conditionally pathogenic microflora, which can be influenced by regular cleaning of animal housing, its disinfection and rodent and insect control. The spread of antibiotic resistance can cause problems in livestock farming because the treatment of bacterial infections becomes more difficult and when animals are sick (either individually or in groups), it is not possible to speak of good living conditions.

In high-end farming, farmers are already expected to raise food animals without antibiotics under guaranteed conditions. There are several risk factors for animal welfare during transport. It is important to assess animals' fitness for transport correctly and just loading and unloading have stressful effects on animals. Stress levels increase especially on long journeys (over 8 hours), where animals are exposed to weather conditions, confined space, effects of driving, competition for feed and water, and there is also a higher risk of injury. These issues are less significant in respect of animals' transport or relocation within Slovakia as regards duration, but even here, the question of animals' fitness to travel and the ways in which animals are handled must not be underestimated.

The whole process of ensuring animal welfare during transport is covered in the approval of animal transporters and means of transport, and in professional training. Animal welfare on farms and during transportation are subject to year-round inspection by state veterinary authorities. Animal husbandry professionals in pig and broiler chicken farming are required by law to attend training courses on animal welfare and an equivalent qualification requirement applies for animal transporters. Official veterinarians can participate in the National Training Programme or animal protection training courses organised by the European Commission.

Biosecurity is the product of preventative measures undertaken to prevent the introduction of infectious agents into livestock and its transmission between animals and thus to minimise the occurrence of diseases. The issue can be divided into several aspects: the housing and organisation of livestock, rules for the movement of animals and persons and regular control of animal health through diagnostics and vaccination. Control of animal health through diagnostics and the compulsory vaccination of animals is regulated by a strategic document on the prevention and control of animal diseases in the territory of the Slovak Republic that is proposed by the Chief Veterinary Officer of the Slovak Republic and approved by the Ministry of Agriculture and Rural Development ("Plan for veterinary prevention and protection of the state territory of the Slovak Republic for the current year")

Basic recommended measures that can help prevent disease and reduce the need for antimicrobials in all animal species:

1. implementation of biosecurity and hygiene measures: use of separate clothing and footwear for each livestock holding; restricting access of persons and animals to livestock holdings; making available facilities for washing and disinfecting hands, work tools and devices; ensuring the rapid removal of dead animals and preventing access to them; the application of an "all-in all-out" management system for livestock (black and white system); adherence to a strict cleaning and disinfection schedule and regular disinfection checks; rodent control,
2. elaboration of good farming practices or operational rules and procedures for ensuring and checking cleanliness and hy-

giene in livestock; prevention of infectious diseases and managing critical situations in livestock holdings,

3. improving animal husbandry conditions by building adequate housing, creating an appropriate environment for animals in accordance with animal welfare requirements with proper ventilation; using appropriate and clean means of transport and the like,
4. the establishment of animal husbandry systems that prevent the purchase and transport of animals of unknown health status and the admission of animals to a holding before the farmer knows their health status (animal quarantine),
5. ensuring adequate fencing for livestock and the closure of husbandry facilities to prevent incursions by other wild and domestic animals,
6. avoiding stressful situations that could weaken animals' immune systems and increase their susceptibility to infection through, for example, proper handling of animals, limiting the transport of animals, minimising transport time by using appropriate approved means of transport and compliance with the recommended animal population density,
7. informing animal husbandry professionals about the principles of the correct use of antimicrobials, the consequences of antimicrobial use in animals in terms of the risk of antimicrobial resistance, and thus help to minimise their use (brochures, leaflets, websites, seminars, training, courses). The information provided to animal husbandry professionals should include information on preventative measures supporting animal health, especially those related to the implementation of biosecurity measures and appropriate agricultural practices

4.3.4 Education on anti-infective therapy, HAIs and hospital hygiene

Education for healthcare professionals and public information

Increased knowledge of microbiology, infectious diseases, anti-infective therapy and hospital hygiene will lead to the optimisation of the comprehensive management of anti-infective therapy. It is necessary to strengthen the educational activities in specialisation studies and continuous education for doctors, dentists and their team members – taking account of issues related specifically to work in a dental practice – and other health care workers. Experience from anti-infective therapy and HAIs should be given more prominence in the theoretical part of specialisation studies. Proposed measures:

Continuous education

- every doctor should have annual training on anti-infective therapy, sepsis, HIAs, vaccinology and microbiological diagnosis,
- every 3 years, healthcare professionals in institutional healthcare facilities should be trained in proper hand washing with UV lamp control,
- within 6 years, existing ICT resources and their interfaces with microbiology laboratory databases should allow doctors to compare their ATB prescriptions with those of other specialists in their field,
- to organise educational events to mark "Antibiotic Awareness Day",
- to hold a national conference under the auspices of the MH SR on HAIs, sepsis and anti-infective therapy, which will include a review of

HAIs, resistance and national/regional data on anti-infective therapy,

- HAIs, sepsis and anti-infective therapy will be highlighted as part of standard diagnostic and therapeutic procedures, into which they will be incorporated by a team of authors made up specialists in all the relevant medical disciplines.

Public information:

- set up a website to educate the public on HAIs, vaccination and rational anti-infective therapy including guidelines for how patients should use ATBs correctly,
- cooperate with patient organisations to implement educational programmes,
- stress the importance of hand hygiene for patients,
- to provide for Slovakia's annual participation in "Antibiotic Awareness Day" activities; the campaign should include a press conference, educational events for patients and presentations in the media (print, electronic, internet).

Education of veterinarians and the public on AMR

The action plan on AMR includes education at undergraduate and postgraduate levels and education for the professional community and the public. Continuous education in the undergraduate period increases awareness and spreads knowledge about antimicrobial resistance.

Tools

Strengthening teaching on antimicrobial resistance, its origin and development, with reference to the correct use of antimicrobials in veterinary practice for students at the University of Veterinary Medicine and Pharmacy ("UVMP") in Košice.

Veterinarians:

Undergraduate education:

Future veterinarians first acquire information and knowledge on antimicrobial resistance as students at UVMP in Košice when learning the correct procedure for disease diagnosis leading to an appropriate therapy plan. The University of Veterinary Medicine and Pharmacy in Košice designs its undergraduate courses (e.g. in the Department of Pharmacology and Toxicology and the Department of Microbiology and Immunology) to provide adequate coverage of antimicrobial resistance and the cautious use of antimicrobials.

- Ensure appropriate teaching on anti-infective therapy in each clinical discipline.
- Practical training should include the collection of material for microbiological examination from sick animals, antibiogram analysis and resistance assessments for diagnosed pathogens, proposal of treatment and the duration of treatment by species.
- To teach students the principles of self-evaluation (audit) of animal treatment using anti-infectives.
- Assign dissertation topics in the areas of anti-infective therapy, the advantages of vaccination over antimicrobials in animal treatment and alternative treatment methods for animals.
- When teaching pharmacology, keep students informed of new guidelines of the European Medicines Agency on the responsible use of antimicrobials in veterinary practice.

Postgraduate education of state veterinarians:

- The SVFA SR, as the competent authority in this area, elaborates an annual training plan for veterinary inspectors and official veterinarians. Education is provided by the Institute of Postgraduate Education of Veterinary Surgeons in Košice ("IPEVS"). This institute is an education and congress facility of the Ministry of Agriculture and Rural Development of the Slovak Republic primarily focused on human resources development.
- Under the leadership of the European Medicines Agency (EMA) and the European Commission the EU Network Training Centre (EUNTC) has been set up as a special programme to empower Member States' medicines agencies to organise special training for the staff of regulatory agencies in fields related to the quality, safety and efficacy of veterinary medicinal products. Postgraduate programmes in pre-attestation training for the first and second attestations of veterinarians will give adequate attention to the problem of antimicrobial resistance, the cautious use of antimicrobials and communication of current knowledge in these areas.
- The national training programme for DVFA and VFI inspectors includes, in training provided by the SVFA SR and the ISCVBM, includes targeted training on the issues of AMR and drug policy, including implementation of controls on the movement of medicinal products in the market and, not least, on control of antimicrobial use. DVFA inspectors will be regularly informed on current knowledge in this area.
- The SVFA SR has incorporated AMR monitoring in the training plan for veterinary food hygiene inspectors. Training is provided every year and inspectors receive training on AMR monitoring issues twice per year on average.
- Inspectors from the SVFA SR, the DVFAs, the ISCVBM and VFIs take part in training organised by the European Commission under the "Better Training for Safer Food" programme focusing on antimicrobial resistance, drug policy, veterinary drug residues and welfare issues.
- After completing the training organised by the European Commission, the trained veterinarians will share their knowledge at training organised on the national level.
- Specialists from the ISCVBM responsible for the registration, laboratory testing and inspection of correct manufacturing and distribution practice will take part in EUNTC training that includes coverage of AMR issues.
- Specialists from the SVFA SR and the ISCVBM will participate in conferences and workshops organised by the European Commission that cover AMR in connection with the responsible use of antimicrobials, environmental issues relating to pharmaceutical and agricultural production, animal husbandry and treatment.
- Specialists from the SVFA SR and the ISCVBM will attend the conference of the CVS SR each year and inform private veterinarians about new AMR guidelines and trends.
- The ISCVBM will update its website with links to the EMA's current AMR guidelines and to current WHO, OIE and EFSA guidelines on AMR

Doctoral studies

- The UVMP in Košice will offer topics related to anti-infective therapy in the

fields of internal medicine, surgery, epidemiology, gynaecology and obstetrics and pharmacology.
- The UVMP in Košice will offer topics related to the development and transmission of resistance and the genotyping of pathogen resistance

Public information:
- Improve the quality of education and information using up-to-date knowledge of antimicrobial resistance and the cautious use of antimicrobials to achieve reductions in antimicrobial resistance in livestock husbandry.
- Publications in specialist and animal husbandry journals will be used to increase awareness of AMR resistance issues among professionals and the general public.
- The SVFA SR will publish specialist articles in the Slovak Veterinary Journal on AMR and the risks associated with the irresponsible use of antimicrobials.

Education of private veterinarians:

Undergraduate education:
- The CVS SR will offer selected veterinarians to act as tutors, by agreement with the UVMP in Košice, on applied pharmacology in professional veterinary practice as part of the education of students of UVMP.
- The CVS SR will allow full-time students to participate in educational events organised in the schedule of educational activities for private veterinarians.

Undergraduate education:
- The CVS SR will organise educational events on AMR issues on the regional level (meetings of members of the Presidium and RCVS SR in each region),
- The CVS SR will organise a section on AMR issues at its upcoming congress in Jasná,
- The CVS SR will publish articles on AMR issues in its professional journal to inform its members about the preparation of the Action Plan on AMR,
- The CVS SR will keep its members up to date on AMR news through a mailing list,

Public information:
- The CVS SR will cooperate with animal husbandry associations on education for the professional community (farmers and animal technicians who cooperate in the treatment of livestock),
- The CVS SR will support members' publications about AMR and the risks that it poses for the public in professional journals on animal husbandry.

4.3.5 Use of ICT and E-Health in controlling HAIs and the rationalisation of anti-infective therapy

Human medicine

Instruments on the national level:
- creation of a tool to implement overviews of resistance, the incidence of HAIs and the consumption of anti-infectives on the level of individual healthcare providers in information systems,
- provision for the electronic reporting of HAIs using electronically assisted tools – i.e. the connection of results from microbiology laboratories, antibiotic prescriptions for automatic confirmation (or HAI elimination),
- connection between EPIS and the information systems of individual healthcare facilities,
- mobile applications to assist doctors in handling HAIs and the diagnosis

and treatment of the most common infections,

- within 6 years, a system allowing doctors to compare their ATB prescriptions with those of other specialists in their field using existing ICT resources and their interfaces with microbiology laboratory databases,
- incorporation of issues related to HAIs, antibiotic resistance, sepsis and vaccination as priorities in E-Health education portals,
- resources providing patients with information on individual healthcare providers' incidences of HAIs and resistance.

Veterinary medicine

Use of information technology in AMR control, the reporting of disease and the rationalisation of anti-infective therapy

Instruments on the national level:

- Within 3 years, set up electronic reporting of results on antimicrobial resistance from the microbiology laboratories of the State Veterinary and Food Institute in Dolný Kubín to the Veterinary Information System (VIS) for both official and private samples.
- Within 3 years, the existing VIS results should allow veterinarians to audit their own antibiotic use. Standard procedures should be elaborated for such audits. Veterinarians should be able to compare their ATB prescriptions with antibiogram or resistance results.
- Enable animal husbandry professionals to obtain information on the state of antimicrobial resistance in their livestock holding (i.e. its AMR profile) through the Veterinary Information System.

4.3.6 Joint activity of the MH SR and the MARD SR

Proposed measures:

- supplement the SNARS.sk database with veterinary data related to antimicrobial resistance monitoring in accordance with Commission Implementing Decision No 2013/652/EU,
- within 5 years, establish cooperation with the Slovak Academy of Sciences for scientific research on the targeted monitoring of mechanisms of resistance development in selected pathogens that is linked to the needs of veterinary practice,
- link research of the Slovak Academy of Sciences on antimicrobial resistance with the related activities of the Ministry of Agriculture and Rural Development (MARD SR), the State Veterinary and Food Administration (SVFA SR) and the Institute for State Control of Veterinary Biologicals and Medicaments (ISCVBM)
- improve interdepartmental cooperation in the evaluation of AMR results
- reinforce the CCATAP with one representative each from the MARD SR and the SVFA SR.
- set up a link on the website of the ISCVBM in Nitra allowing the direct submission of reports of adverse effects of veterinary medicinal products, including lack of effectiveness and veterinary drug residues,
- monitor each other's scientific information on the status and development of AMR and the measures taken by other Member States to combat AMR,

- work on research projects of the University of Veterinary Medicine aimed at the use of probiotic bacteria in veterinary practice to replace the antibiotics formerly used to maintain animal health,
- create a joint program monitoring the transfer of resistance between the MH SR and the MARD SR.