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National Action Plan on Antimicrobial Resistance in Romania

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Avizat din partea echipei proiectului,

Prof. dr. Alexandru RAFILA
Expert tehnic șef medical

Prof. dr. Ștefan Sorin ARAMĂ
Manager de proiect

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Autori :

Prof. Univ. Dr. Alexandru Rafila, Institutul Național de Boli Infecțioase „Prof. Dr. Matei Balș”,
Universitatea de Medicină și Farmacie „Carol Davila” din București

Prof. Univ. Dr. Adrian Streinu-Cercel, Institutul Național de Boli Infecțioase „Prof. Dr. Matei Balș”,
Universitatea de Medicină și Farmacie „Carol Davila” din București

Conf. Univ. Dr. Adriana Pistol, Institutul Național de Sănătate Publică, Centrul Național de
Supraveghere și Control al Bolilor Transmisibile, Universitatea de
Medicină și Farmacie „Carol Davila” din București

S.L. Dr. Dragoș Florea, Institutul Național de Boli Infecțioase „Prof. Dr. Matei Balș”, Universitatea
de Medicină și Farmacie „Carol Davila” din București

S.L. Dr. Gheorghiu Valeriu, Spitalul Universitar de Urgență Militar Central „Dr. Carol Davila”,
Universitatea de Medicină și Farmacie „Carol Davila” din București

S.L. Dr. Dorina Maria Crăciun, Spitalul Clinic de Urgență pentru Copii „Grigore Alexandrescu”,
București, Universitatea de Medicină și Farmacie „Carol Davila” din
București

S.L. Dr. Teodora Vremeră, Institutul Național de Sănătate Publică, Centrul Național de
Supraveghere și Control al Bolilor Transmisibile

Dr. Anca-Cristina Drăgănescu, Institutul Național de Boli Infecțioase „Prof. Dr. Matei Balș”

Dr. Roxana-Ioana Șerban, Institutul Național de Sănătate Publică, Centrul Național de
Supraveghere și Control al Bolilor Transmisibile

Dr. Andreea-Sorina Niculcea, Institutul Național de Sănătate Publică, Centrul Național de
Supraveghere și Control al Bolilor Transmisibile

Cu contribuția:

Dr. Ute Soenksen, Biroul pentru România al Organizației Mondiale a Sănătății

Dr. Antoaneta Drăgoescu, Biroul pentru România al Organizației Mondiale a Sănătății

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adresa e-mail: proiect.amr@yahoo.com

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Abbreviations and acronyms

AFM	Administration of the Environment Fund
AMR	Antimicrobial resistance
AST	Antimicrobial susceptibility testing
ATLASS	Assessment Tool for Laboratory and Antimicrobial Resistance
AWaRe	Access, Watch and Reserve
CDI	<i>Clostridium difficile</i> infections
CLSI	Clinical and Laboratory Standards Institute
CVD	College of Veterinary Doctors
CSVFSD	County Sanitary Veterinary and Food Safety Directorates
DDD	Defined Daily Dose
EARS-Net	European Antimicrobial Resistance Surveillance Network
ECDC	European Centre for Disease Prevention and Control
EEA	European Area
EFSA	European Food Safety Authority
EMA	European Medicines Agency
ESAC-Net	European Surveillance of Antimicrobial Consumption
ESVAC	European Surveillance of Veterinary Antimicrobial Consumption
ESBL	Extended Spectrum Beta-Lactamase
EU	European Union
EUCAST	European Committee on Antimicrobial Susceptibility Testing
EURL	European Union Reference Laboratory
FAO	Food and Agriculture Organization
GAP	Global Action Plan
GLASS	Global Antimicrobial Resistance Surveillance System
GMP	Good manufacturing practices
HACCP	Hazard Analysis Critical Control Point
HAI	Healthcare Associated Infection
IACG	Interagency Coordination Group
ICBPVM	Institute for Control of Biological Products and Veterinary Medicine
IDAH	Institute of Diagnostic and Animal Health
IHR	International Health Regulation
IHVPH	Institute of Hygiene and Veterinary Public Health
MDR	Multidrug Resistance
NAP	National Action Plan
NCLAR	National Committee for Limiting the Antimicrobial Resistance
NHPs	National Health Programmes
NIPH	National Institute of Public Health
NRL	National Reference Laboratory
NSVFSA	National Sanitary Veterinary and Food Safety Authority
OIE	World Organisation for Animal Health
RASFF	Rapid Alert System for Food and Feed
SDGs	Sustainable Development Goals
UN	United Nations
VMP	Veterinary Medicine Products
WASH	Water Sanitation and Hygiene
WHO	World Health Organisation

Background

Introduction

Human health, animal health and the environment are interconnected, and infections are transmitted from humans to animals and vice versa. Therefore, infections must be treated and controlled in both humans and animals, taking into account also the food chain and the environment, which can be another source of resistant microorganisms.

Antimicrobial resistance (AMR) is a global problem that impacts all countries and all people, regardless of their wealth or status.

In May 2015 at the Sixty-eighth World Health Assembly, Member States of the **World Health Organization** (WHO) adopted a „Global Action Plan on Antimicrobial Resistance” (GAP)¹. Member States agreed on the importance of developing national action plans (NAPs) aligned with the global plan and incorporating the same five strategic objectives.

The goal of the AMR global action plan is: “To ensure, for as long as possible, continuity of successful treatment and prevention of infectious diseases with effective and safe medicines that are quality-assured, used in a responsible way, and accessible to all who need them”.

Its five strategic objectives are:

- Objective 1: Improve awareness and understanding of antimicrobial resistance through effective communication, education and training.
- Objective 2: Strengthen the knowledge and evidence base through surveillance and research.
- Objective 3: Reduce the incidence of infection through effective sanitation, hygiene and infection prevention measures.
- Objective 4: Optimize the use of antimicrobial medicines in human and animal health.
- Objective 5: Develop the economic case for sustainable investment that takes account of the needs of all countries, and increase investment in new medicines, diagnostic tools, vaccines and other interventions.

The World Assembly of Delegates of the World Organisation for Animal Health (OIE), also held in May 2015, adopted a resolution for Member Countries to follow the guidance of the global action plan by developing national action plans in respect of the use of antimicrobial agents in animals and ensuring their close collaboration with public health officials².

In June 2015, the Thirty-ninth Conference of the Food and Agriculture Organization of the United Nations (FAO) adopted a resolution on AMR, which urges members to „develop or strengthen national plans, strategies and international collaboration for the surveillance, monitoring and containment of antimicrobial resistance in food, agriculture and the environment, in close coordination with related plans for human health”³.

A year later, in 2016, the GAP was reaffirmed as the world’s blueprint for tackling AMR during the 71st session of the UN General Assembly, where 193 Heads of State adopted resolution A/RES/71/3, which included a high-level political declaration committing countries to support and implement the GAP at national, regional and global levels⁴. Since then, the global Ad-hoc Interagency Coordination Group on AMR (IACG) established by the UN Secretary General because of the declaration has developed a „Framework for Action” that puts AMR in the wider context of the Sustainable Development Goals (SDGs), helping to align political agendas and provide a common language and a dynamic structure for all sectors to work from, while respecting countries’ endorsement of the GAP.

In June 2017, members of the Tripartite (Food and Agriculture Organization of the United Nations, World Organisation for Animal Health, World Health Organization) convened a meeting of human and animal health experts from around the world to get advice on potential indicators⁵. Following the June 2017 meeting, a draft M&E approach was published for public consultation with the wider international community. The Tripartite, taking into account the feedback from the consultation, then finalized the M&E framework document ensuring a balanced and coherent approach that predominantly draws on existing data sources.

The main impact of antimicrobial resistance is on human health, but both the contributing factors and the consequences, including economic and others, go beyond health, and that there is a need for a coherent, comprehensive and integrated approach at global, regional and national levels, in a „**One Health**” approach and beyond, involving different actors and sectors such as human and veterinary medicine, agriculture, finance, environment and consumers⁶.

In a tripartite approach, FAO, OIE and WHO recognize that addressing health risks at the human-animal-plant-ecosystems interfaces requires strong partnerships among entities that may have different perspectives and different levels of resources.

A framework for collaboration is therefore needed at national and international levels, with clear roles and responsibilities. Furthermore, plant, animal and human health institutions and partnerships should also be strengthened in the management of existing and emerging plant, animal and zoonotic diseases in order to reduce the use of antimicrobials in livestock production, aquaculture and agriculture⁷.

The Member States of the **WHO European Region** were adopted „The European Strategic Action Plan on Antibiotic Resistance 2011-2020” at the 61st session in September 2011⁸.

The strategic plan covers the following 7 key areas of action⁹:

- Promote national intersectoral coordination by developing comprehensive national action plans and establishing multisectoral and interdisciplinary coordination mechanisms.
- Strengthen surveillance of antimicrobial resistance (AMR) through national surveillance systems, collecting, analysing and reporting data to monitor trends.
- Strengthen surveillance and promote stewardship of antimicrobial drug use using national mechanisms for coordination, developing national guidelines for prudent use of antibiotics and surveillance of antibiotic consumption.
- Strengthen surveillance of resistance to and use of antimicrobial agents in the food animal industry through prudent use of antibiotics in these sectors, and integrate systems for surveillance of antibiotic resistance and use.
- Improve infection control and stewardship of AMR in health care settings by preventing hospital-acquired infections, and establish hospital infection control and surveillance committees.
- Promote research and innovation on new drugs and technology by sharing information on promising research areas and taking an active role in research for governments and academic networks, facilitating national and international task forces.
- Ensure patient safety and improve awareness of antimicrobial use and resistance through educational initiatives, behaviour change campaigns and awareness programmes for health care providers and the public. Moreover, establish broad partnership at national, regional and global levels.

The strategic objectives are developed as guidance to national governments to address the complex factors that relate to bacterial resistance and its driver, antibiotic usage (especially overuse and misuse). They take into account the technical, financial, regulatory, educational and behavioural

aspects that need to be addressed in comprehensive national plans of action. The regional strategic action plan should be used by policy-makers and other national stakeholders as an initial framework on which national action plans, guidance, regulations and organizational arrangements can be based. Antimicrobial resistance is a crosscutting issue, and measures to counter it require inputs from and participation by many national and sometimes international partners, stakeholders or experts.

These objectives further emphasize the need to better understand the underlying causes of antibiotic resistance and to develop laboratory capacity in order to monitor national trends in antibiotic resistance, especially in life-threatening infections but also with regard to emerging mechanisms of resistance that can further affect the treatment and prevention of bacterial infections in outpatient settings. These monitoring and surveillance systems should also be linked to mechanisms for international reporting of antibiotic resistance and consumption, since the globalization of travel and trade facilitates their international spread.

The European Parliament, in July 2018, in the Report¹⁰ of the Committee on Environment, Public Health and Food Safety, says that addressing antimicrobial resistance should focus on the holistic concept based on the "One Health" in order to ensure better coordination of activities in the field of public health and veterinary health.

Situational analyses and assessment

Antimicrobial resistance (AMR) refers to resistance to drugs used to treat infections that have been caused by bacteria and other microbes, such as parasites, viruses and fungi. Antibiotics have become one of the basic pillars of modern medicine, being the basis of treatment against bacterial infections in humans and animals. However, successfully treating bacterial infections is becoming more difficult because of resistance, which naturally occurs over time.

Factors that accelerated the phenomenon of antimicrobial resistance were:

- Improper use (misuse and overuse) of antibiotics both in human medicine (e.g., use as treatment for viral infections, in which they are ineffective) and in the field of animal breeding (e.g., prophylaxis and growth),
- Transmission of resistant bacteria from animals to humans through direct contact or through the food chain or environment and release of antimicrobial substances into the environment,
- Improper disposal of unused medicines in groundwater,
- Insufficient development of new antibiotics.

Proper and prudent use of antimicrobials is essential to limit the occurrence of antimicrobial resistance in the human health care, animal husbandry and aquaculture sectors.

The correct use of antibiotics must be ensured through education and information. It is essential to develop continuing education and training facilities for medical professionals, who will address the subject of the correct use of antibiotics. Also, the population needs to be better informed about the viral origin of many infectious diseases and the prudent use of antibiotics. In veterinary medicine, the use of antibiotics for preventive purposes is regulated, in accordance with the provisions of the new EU regulation on veterinary medicinal products.

Current structures and activities related to antimicrobial resistance in Romania

Ministry of Health

It functions as a central authority in the field of public health, subordinated to the Government, whose role is to ensure and coordinate public health assistance, to elaborate policies, strategies and programs in the field of health population, to regulate the organization and functioning of the health system.

The main normative acts that refer to the health-care associated infections (HAIs), are:

- a) Government Decision no. 1028/2014¹¹ regarding the approval of National Health Strategy 2014-2020 and the Action Plan for the implementation of National Strategy 2014-2020.

In this strategy, the General Objective 2 - "Reducing morbidity and mortality through communicable diseases, their impact at the level of individual and society", includes the following specific objectives:

- Strengthening the capacity of the national system for the surveillance of priority communicable diseases, for early warning and coordinated response;
- Protecting the health of the population against the main diseases that can be prevented by vaccination;
- Reducing morbidity and mortality through TB and maintaining adequate rates of detection and therapeutic success;
- Reducing the incidence of priority communicable diseases: HIV / AIDS and ensuring the access of patients to antiviral treatments;
- Reducing the incidence of priority communicable diseases: hepatitis B and C and ensuring the access of patients to antiviral treatments.

The main measures relate to:

- Conducting studies of prevalence and analysis of routine indicators for improving the effectiveness of the surveillance and control of HAIs and of the biological occupational risks in the medical personnel;
- elaboration of methodologies and action plans;
- Conducting studies/analyses to improve the effectiveness of surveillance and control of HAIs;
- Revision / elaboration of methodologies according to the needs of improving the supervision of the control of HAIs.

- b) Government Decision no. 155/2017¹² for the approval of the National Health Programmes (NHPs) for the years 2017 and 2018 (extended for the period 2019-2020), which include the preventive and curative programmes, and Order of Ministry of Health no. 377/2017¹³ for approval the method of implementing the preventive health programmes.

Within the 6 preventive programmes, two are related to the activity of combating antimicrobial resistance:

- National programmes for communicable diseases, which include: National vaccination programme; National programme for surveillance and control of priority communicable diseases; National programme for prevention, surveillance and control of HIV / AIDS infection; National programme for the prevention, surveillance and control of tuberculosis; National programme for surveillance and limitation of health-care associated infections and microbial resistance, as well as monitoring the use of antibiotics.
- National programme for health evaluation and promotion and education for health, for the component of interventions for a healthy lifestyle, which includes information / education / communication campaigns aimed at health priorities.

- c) Order of the Ministry of Health no. 1101/2016¹⁴ regarding the approval of the Norms of supervision, prevention and limitation of the HAIs in the health units.

The rules use the case definitions provided in Decision 2012/506/EU¹⁵ and are organized into four chapters, as follows:

- Organizing the activities of surveillance, prevention and limitation of the HAIs in the public and private sanitary units with beds;
- Surveillance and reporting of HAIs;
- The methodology for monitoring the accidental exposure of the personnel working in the sanitary field to biological products;
- Standard precautions - mandatory minimum measures for prevention and limitation of HAIs.

Based on these rules, each health unit develops its own annual program for surveillance, prevention and limitation of health-care associated infections.

National Institute of Public Health (NIPH)

It is a public institution subordinated to the Ministry of Health, which whose main attributions are¹⁶:

- Technical and methodological guidance of the public health network,
- Surveillance of the population health status, communicable and non-communicable diseases in order to identify community health problems,
- Elaboration of the methodology, instruments and indicators for monitoring and evaluation of the public health services and programs, health promotion and health education, and
- Ensuring the integrated information system for public health management.

NIPH is the technical assistance and management unit for the following NHPs^{12,13}:

- vaccination;
- surveillance and control of priority communicable diseases, with the following activities: epidemiological surveillance of communicable diseases, intervention in the outbreak, conducting epidemiological studies to evaluate the incidence and prevalence of infectious diseases;
- surveillance and limitation of HAIs and microbial resistance, as well as monitoring the use of antibiotics, with the main activities: surveillance in the sentinel system of HAIs in high risk sections (ICU, surgery); surveillance of microbial strains that cause invasive infections, in the sentinel system; professional training of medical personnel for the surveillance and limitation of HAIs, as well as for monitoring the use of antibiotics; conducting the current prevalence study of HAIs and antibiotic use in the hospital;
- health evaluation, promotion and education, with main activities which refer to the organization and deployment: Campaigns for World / European days; Information / education / communication - interventions aimed at health priorities; Interventions for health promotion in vulnerable communities and groups; Information / education / communication - interventions for the implementation of county action plans for healthy eating and physical activity in children and adolescents.

National Sanitary Veterinary and Food Safety Authority

The Romanian governmental structure monitoring antimicrobial resistance and the use of antimicrobials in the veterinary field is the National Sanitary Veterinary and Food Safety Authority. This

regulatory and control structure in the sanitary veterinary field is subordinated to the Government and coordinated by the Prime Minister.

In antimicrobial VMPs field, the NSVFSA:

- regulates – draws up and implements European and national specific legislation starting with VMP manufacturers/ importers authorized and certified GMP, wholesale and retail distributors, to free practice vets
- supervises and controls VMPs from manufacture to use through annual control programs on the circulation and use of VMPs and also VMPs sampling and testing annual program;
- carries out national control plans for residues (including antimicrobials residues);
- provides training for official veterinarians and collaborates with stakeholders and farmers associations.

In the AMR field, the NSVFSA,

- regulates - draws up and updates or proposes amendments/completions to the legislative framework for AMR domain at EU and national level,
- draws up yearly the AMR national monitoring plan, monitor and report the results to EFSA on trends and sources of zoonoses, zoonotic agents and antimicrobial resistance provided for in Article 9(1) of Directive 2003/99/EC,
- provides training for official veterinarians and collaborates with stakeholders

At county level, the CSVFSD mirrors the structure of the central authority and ensure that EU, national legislation and technical instructions issued by the NSVFSA in the field of VMP and AMR are properly implemented and enforced throughout the country.

At national level and subordinated to NSVFSA are organised:

2 National Reference Institutes for AMR monitoring:

- Institute of Diagnosis and Animal Health (IDAH) – national reference lab for AMR monitoring in animals
- Institute of Hygiene and Veterinary Public Health (IHVPH) – national reference lab for AMR monitoring in products of animal origin

IDAH coordinates a network of designated county laboratories for AMR and together with IHVPH perform tests and selects the isolates to be subject to AST. The collaboration between both NRLs for AMR and the European Union Reference Laboratory (EURL) is ensured through participation in workshops, proficiency tests and regular exchanges of information. Both NRL laboratories alternate their participation in these events.

1 National Reference Institute for VMPs:

- Institute for Control of Veterinary Biological Products and Medicines – that performs VMPs marketing authorization, quality control, data collection and centralization of antimicrobial VMPs sales.

Ministry of Environment, Waters and Forests

The Ministry of Environment, Waters and Forests²³ implements the policy at national level in the fields of environmental protection, green economy, biodiversity, protected natural areas, climate change

regarding all sectors and subsectors it manages, elaborates specific development strategy and regulations, fulfills the role of state authority, having activities of synthesis, coordination, regulation, monitoring, inspection and control in these fields.

Areas of competence of the Ministry of Environment, Waters and Forests are:

- industrial pollution control;
- air quality and ambient noise;
- management of protected natural areas, biodiversity conservation, biological security;
- environmental infrastructure;
- waste management;
- management of hazardous chemicals and preparations;
- soil and subsoil protection;
- Sustainable Development;
- green economy;
- climatic changes.

With the main objectives of strengthening administrative structures - as a basic element for building a solid environmental management system - and contributing to sustainable development, the Ministry of Environment has set the following priorities:

- a) integrating environmental protection requirements into other sectoral policies, in line with European and international requirements and standards,
- b) biodiversity protection,
- c) improving the quality of environmental factors in urban and rural areas.

Through the Administration of the Environment Fund (AFM), the following categories of projects eligible for funding can be supported and implemented:

- pollution prevention;
- reducing the impact on the atmosphere, water and soil;
- noise reduction;
- use of clean technologies;
- waste management, including hazardous waste;
- protection of water resources, treatment plants, treatment plants for local communities;
- integrated coastal zone management;
- biodiversity conservation;
- administration of protected natural areas;
- education and public awareness on environmental protection;
- increasing the production of energy from renewable sources;
- reduction of greenhouse gas emissions;
- ecological reconstruction and sustainable forest management;
- afforestation of degraded lands located in deficient areas in forests, established under the law;
- the closure of tailings ponds in the mining sector;
- works intended to prevent, remove and / or reduce the effects produced by dangerous meteorological phenomena on water management works related to the objectives in the public domain of the state.

Ministry of Agriculture and Rural Development

The Ministry of Agriculture and Rural Development²⁴ is the central public authority responsible for implementing the government strategy and program, with a role in developing and implementing national sectoral strategies in agriculture and food production, rural development, land improvement and related fields: specialized scientific research, conservation and sustainable management of soils and plant and animal genetic resources.

The objectives of the Ministry of Agriculture and Rural Development are the following:

- a) ensuring national food security by increasing and diversifying agricultural production, in order to guarantee the population sufficient, safe and nutritious food;
- b) increasing the competitiveness of Romanian agri-food and fishery products on the European and global market in order to balance the agricultural trade balance, including through specific information actions;
- c) the absorption of community funds destined to finance specific fields;
- d) financial and fiscal support of agriculture through multiannual programs;
- e) streamlining the agricultural and agri-food market structures;
- f) stimulating the establishment of warehouses for the collection, sorting and capitalization of agricultural products;
- g) accelerating the rural development process, including rural services;
- h) modernization and extension of land improvement infrastructure, adaptation of agriculture to climate change;
- i) development of the fisheries sector;
- j) supporting agricultural research, information, consultancy, extension and professional training in agriculture;
- k) the reform of the administrative structures with attributions in the field of agriculture, with the observance of the legal provisions in force;
- l) development and protection of the mountain area.

Capacity and structures of antimicrobial use and resistance

Surveillance system in the human medical field

The Ministry of Health, through the National Institute of Public Health (NIPH), carries out activities to monitor antimicrobial use and resistance.

The activities carried out by NIPH are:

- a) Sentinel surveillance of health care-associated infections (HAI)

This type of surveillance is a method used to estimate the real incidence of health care-associated infections and because it allows a better evaluation of this public health problem in the selected units.

Document used: Methodology for surveillance in the sentinel system of HAI and microbial resistance²⁵.

The sentinel surveillance system includes:

- Surveillance of the following types of infections: septicaemia, pneumonia, urinary infections, secondary infections using medical devices (central/peripheral venous catheter), surgical site infections;
- Monitoring of microbial resistance: characterization of the strains that cause invasive infections.

Target population: all patients hospitalized in the sentinel healthcare unit with a minimum of 2 days hospitalization (more than 48 hours after admission to the department).

Surveillance of the HAIs sentinel includes the following information:

- The HAI supervised in the sentinel system are: septicemia, pneumonia, urinary infections, secondary infections using medical devices (central / peripheral venous catheter) and surgical site infections.
- The data to be collected refer to: patient, HAIs, surgical site infections, antibiotic characterization.
- Specific laboratory investigations will necessarily address the following microorganisms: *Staphylococcus aureus*, *Enterococcus faecium* and *Enterococcus faecalis*, Enterobacteriaceae (*Escherichia coli*, *Klebsiella pneumoniae*), *Pseudomonas aeruginosa*, *Acinetobacter* spp.

Microbial resistance monitoring includes the following information:

- Target population: all patients hospitalized in the sentinel health unit from which microbial strains have been isolated that cause invasive infections.
- Data collected at the laboratory level: number of strains with antimicrobial resistance isolated from the entire sentinel sanitary unit; the microbial strains responsible for invasive infections (isolated from the blood, cerebrospinal fluid) that will be recorded on specific files.
- Detection of the mechanisms of resistance and specific resistance of clinical and / or epidemiological importance is done by standardized methods (CLSI or EUCAST) for: Enterobacteriaceae producing Carbapenemases, Enterobacteriaceae producing broad-spectrum β -lactamases, Enterobacteriaceae producing AmpC β -lactamases, methicillin resistant *Staphylococcus aureus*, *Staphylococcus aureus* not susceptible to glycopeptides, vancomycin resistant *Enterococcus*, *Streptococcus pneumoniae* not susceptible to penicillin.

b) Current prevalence study of HAI

In 2017, NIPH through the Regional Centre of Public Health Bucharest, elaborated the "Methodology for applying the current prevalence study of health care-associated infections"²⁶.

The current prevalence study is a simple, fast, and relatively inexpensive tool to identify targets that need quality improvement and to evaluate the effect of interventions. Therefore, NIPH has made this standardized methodology available to the sanitary units with beds to estimate the prevalence of HAI and the use of antimicrobial substances.

c) Surveillance of *Clostridioides difficile* infection

NIPH performs annually the "Analysis of the evolution with *C. difficile* in the hospitals in Romania"²⁷, because this pathology represents one of the most serious side effects of the healthcare with hospitalization, both by the incidence and the severity of the disease produced.

The system of surveillance of infection with *C. difficile* was implemented at national level in March 2014, the target population being represented by all inpatients to the public/private hospitals.

NIPH has developed "Clostridium difficile infection (CDI) surveillance methodology"²⁸, for health units.

d) Antibiotic consumption, microbial resistance and health care-associated infections

NIPH through the Regional Centre of Public Health Bucharest, based on the *National Program for the surveillance and control of HAIs and monitoring the use of antibiotics and antibiotic-resistance*, elaborated, for the period 2011-2017, the Report "Consumption of antibiotics, microbial resistance and health-care associated infections in Romania 2017, CARMIN - ROM 2017"²⁹.

Issues addressed in this report, closely interconnected, are:

- Antibiotic consumption is the main determinant of the occurrence of new mechanisms of microbial resistance, including multidrug resistance, but also a trigger factor of infections such as those caused by *C. difficile*, often of nosocomial origin.
- Bacterial antimicrobial resistance reduces the therapeutic alternatives of infections, first of all in the case of health care-associated infections (HAIs), which makes their treatment more difficult and with a higher risk of adverse evolution.
- HAI represents the most visible area of the manifestation of microbial resistance to antibiotics; they are often caused by germs with antibiotic resistance, more often multidrug resistant or with extended resistance, including salvage antibiotics, and the evolution of patients is generally more severe compared to community infections. Sometimes HAIs is caused by the antibiotics use, as is the case with *C. difficile* infections (CDI).
- The treatment of patients with HAI involves more frequent use of last-line antibiotics; thus increasing the level of microbial resistance to them.

e) Information / education / communication campaigns

NIPH through the National Centre for Health Assessment and Health Promotion (NCHAHP), organizes information, education and communication campaigns on topics related to with health care-associated infections (HAI), as follows:

- The multi-annual world campaign "Save lives: hand hygiene!"³⁰ May 5

The World Health Organization launched in 2009 an annual worldwide campaign, addressed to medical personnel, called "SAVE LIFE: hand hygiene!", Which in recent years has focused on: hand hygiene and combating microbial resistance (May 5, 2014); hand hygiene in the surgical departments (May 5, 2016); hand hygiene and combating microbial resistance (May 5, 2017); hand hygiene and septicaemia prevention (May 5, 2018).

For 2019, the theme was "Clean care for all - it's in your hands"

- European antibiotic information day³¹

The European Day of Information on Antibiotics (EDIA), celebrated annually on November 18, is a European public health initiative conducted to raise awareness among professionals, the public and decision-makers about the concern raised by antimicrobial resistance (AMR) and the number patients infected with resistant bacteria.

Surveillance system in the veterinary field

In the AMR field, the National Sanitary Veterinary Health and Food Safety Authority together with the County Sanitary Veterinary and Food Safety Directorates (CSVFSD), the NRLs described earlier in the paper and the designated sanitary-veterinary and food safety laboratories carry out activities according to provisions of the Order of the President of NSVFSA no. 35/2016³² which is systematic aligned to the EU specific legislation on AMR (Decision 2020/1729/EU (for period 2021- 2027) on the monitoring and reporting of antimicrobial resistance in zoonotic and commensal bacteria and repealing the former Implementing Decision 2013/652/EU (period 2013-2020).

According to the legal framework named above the monitoring and reporting of AMR cover the following bacteria *Salmonella* spp, *Campylobacter coli* (*C. coli*), *Campylobacter jejuni* (*C.jejuni*), Indicator commensal *Escherichia coli* (*E. coli*), *Salmonella* spp. and *E. coli* producing the following enzymes Extended Spectrum β -Lactamases (ESBL), AmpC β -Lactamases (AmpC), Carbapenemases (CP) and the following food-producing animal populations and food, respectively broilers, laying hens,

fattening turkeys, bovine animals under one year of age; fresh meat from broilers fresh meat from turkeys fresh meat from pigs fresh meat from bovine animals.

The Institute of Diagnostic and Animal Health (IDAH), and the Institute of Veterinary Hygiene and Public Health (IVHPH), perform tests and selects the isolates to be subject to Antimicrobial Susceptibility Testing (AST). Additionally, both institutes are responsible for assessing the results of the annual AMR monitoring plan and including the assessment in the report on trends and sources of zoonoses, zoonotic agents and antimicrobial resistance provided for in Article 9(1) of Directive 2003/99/EC, which is sent to the European Food Safety Authority (EFSA).

The Guide for the prudent use of antimicrobial substances in veterinary medicine was drawn up and published on the NSVFSA website, in 2016 and updated in 2020 (National guide on the prudent use of antimicrobials in veterinary medicine³⁵). The guide refers to the prudent use of antimicrobial substances in animals and to how to limit the development of antimicrobial resistance, in particular.

The guidance provisions reflect the initiatives recommended in the *Council Conclusions on the impact of antimicrobial resistance in the human health and veterinary sectors - the "One Health" approach*, adopted on June 22, 2012, in the *Report on microbial challenge - the growing threats posed by antimicrobial resistance*, adopted by European Parliament on 10 December 2012 and in the *Resolution on providing safer healthcare in Europe: improving patient safety and combating antimicrobial resistance*, adopted by the European Parliament on 19 May 2015.

The purpose of the guide is to provide veterinary practitioners, farmers, veterinary authorities, the drug industry, associations and academia, the practical guidance on the prudent use of antimicrobial substances, in particular antibiotics, in veterinary medicine³⁶.

Statistical data

Antimicrobial resistance (AMR) in human health

At European level, ECDC manages the data reported by each Member State by collecting them in the *European Antimicrobial Resistance Surveillance Network (EARS-Net)*³⁸ database. ECDC also publishes an annual report "*Surveillance of antimicrobial resistance in Europe*"³⁹.

In Romania, the National Institute of Public Health and the Regional Centre of Public Health Bucharest collect data and coordinate the preparation of reports on bacterial resistance to antibiotics. In 2018, the sixth Report "Antibiotic consumption, microbial resistance and HAIs in Romania 2017, CARMIN-ROM 2017"²⁹ was published.

The data collection activity was mostly supported by the Ministry of Health through the *National Program for Surveillance and Control of Health-care associated infections and Monitoring of antibiotic use and Antibiotic-Resistance*.

Below are the data reported by Romania in the period 2012-2018, for the following categories^{29,38,39}:

A) Gram-positive cocci

A first category is represented by **Enterococci**, the species that can generate invasive infections are *Enterococcus faecalis* and *Enterococcus faecium*.

For *Enterococcus faecalis*, there was a decrease in Gentamicin resistance, from 56.9% in 2012 to 37.5% in 2018, being the sixth highest level recorded in 2018 among the EARS-Net participating states.

For *Enterococcus faecium* there was an increase in resistance to Vancomycin from 2.9% in 2012 to 40.3% in 2018, being the second highest level recorded in 2018 among EARS-Net participating states (table no. I).

Table no. I – *Enterococcus faecalis* și *Enterococcus faecium* antimicrobial resistance, in Romania, from 2012 to 2018

1. Enterococcus faecalis	2012	2013	2014	2015	2016	2017	2018
Gentamicin	56.9%	58.8%	76.5%	0%	56.3%	44.9%	37.5%
Aminopenicillins	2.0%	6.2%	9.3%	20.7%	4.4%	6.4%	1,8%
Vancomycin	0%	1.2%	3.9%	4.4%	2.6%	3.9%	1.1%
2. Enterococcus faecium	2012	2013	2014	2015	2016	2017	2018
Vancomycin	2.9%	11.1%	25.0%	25.0%	39.0%	34.4%	40.3%
Aminopenicillins	94.1%	90.7%	94.5%	63.4%	97.2%	87.5%	94.2%
Gentamicin	85.3%	86.3%	84.2%	ND	78.7%	76.0%	76.0%

Source: EARS-Net 2019, CARMIN-ROM 2017

The second category includes *Streptococcus pneumoniae*, which can cause invasive infections of varying severity, from mild diseases to death. Resistance to treatment with penicillin, macrolides or combinations thereof, has been variable (table no. II) and ranks Romania first among the countries reporting to EARS-Net in 2018.

Table no. II – *Streptococcus pneumoniae* antimicrobial resistance, in Romania, from 2012 to 2018

	2012	2013	2014	2015	2016	2017	2018
Penicillin	38.6%	25.0%	46.7%	39.0%	41.1%	29.1%	40.0%
Macrolide	39.5%	38.1%	48.0%	30.0%	37.3%	26.3%	32.3%
Penicillin + Macrolide	32.6%	21.4%	37.8%	25.0%	30.4%	24.0%	26.7%

Source: EARS-Net 2019, CARMIN-ROM 2017

The third category is *Staphylococcus aureus*, which is one of the main colonizers of the human body. The *Staphylococcus aureus* has developed strains capable of resisting the action of any beta-lactamases, strains that are called MRSA (methicillin-resistant *Staphylococcus aureus*). Resistance to beta-lactamases is decreasing in Romania, but is still the highest among the countries reporting to EARS-Net in 2018 (table no. III).

Table no. III – *Staphylococcus aureus* antimicrobial resistance, in Romania, from 2012 to 2018

	2012	2013	2014	2015	2016	2017	2018
Methicillin-resistant staphylococcus aureus(MRSA)	53.3%	64.5%	56.0%	57.2%	50.5%	44.4%	43.0%
Rifampicin (not reported in EARS-Net)	23.4%	31.3%	17.2%	21.9%	18.8%	15.0%	ND

Source: EARS-Net 2019, CARMIN-ROM 2017

B) Gram-negative bacilli

From this category the results will be presented for: *Escherichia coli*, *Klebsiella pneumoniae*, *Pseudomonas aeruginosa* and *Acinetobacter baumannii*.

Escherichia coli is the Gram-negative bacillus most commonly involved in systemic infections. Antibiotic resistance in the categories: the 3rd generation cephalosporin and aminoglycosides, has registered a downward trend, for which, in 2018 Romania is ranked 7th and 10th among the EARS-Net states with high values.

Table no. IV – *Escherichia coli* antimicrobial resistance, in Romania, from 2012 to 2018

	2012	2013	2014	2015	2016	2017	2018
3rd gen. Cephalosporin	25.1%	22.8%	29.4%	26.8%	23.4%	18.7%	20.2%
Aminoglycoside	24.3%	14.8%	17.2%	18.3%	15.0%	15.2%	12.8%
MDR (3G C +FQ+AG)	15.6%	9.2%	14.4%	13.5%	11.7%	9.7%	7.2%
Aminopenicillins	58.9%	67.4%	68.0%	73.0%	72.3%	68.2%	62.2%
Fluoroquinolone	29.0%	31.0%	31.3%	30.7%	30.6%	26.4%	29.1%
Carbapenemases	0.0%	0.0%	0.7%	1.9%	1.0%	0.4%	0.0%

Source: EARS-Net 2019, CARMIN-ROM 2017

Multidrug resistance (MDR) to the 3rd generation cephalosporin, fluoroquinolones and aminoglycosides, has been on a downward trend, Romania being 9th in the high values category than the EU/EEA average (table no. IV).

For the resistance to Carbapenemases, which has decreased in the last three years, Romania ranks 11th in the hierarchy of EARS-Net states with the lowest values.

Klebsiella pneumoniae produces infections whose severity varies, and in cases of systemic infection, especially if they are produced by multidrug resistant strains, the lethality is high. Germs are a major public health problem, as they produce new carbapenemases, which then can be transmitted to other *Enterobacteriaceae*.

Resistance to Carbapenemases has increased, which is why Romania has the third highest value among EARS-Net states in 2018. For 3rd generation cephalosporin, aminoglycosides and fluoroquinolones, antimicrobial resistance, even if decreased, is maintained at values above 50%, placing Romania in 4th and 5th place in the EARS-Net hierarchy. In addition, multidrug resistance (aminoglycosides, fluoroquinolones and 3rd generation cephalosporin), although decreased in the last year to 46.3%, remains fifth above average between EU/EEA states (table no. V).

Table no. V – *Klebsiella pneumoniae* antimicrobial resistance, in Romania, from 2012 to 2018

	2012	2013	2014	2015	2016	2017	2018
Carbapenemases	13.7%	20.5%	31.5%	24.7%	31.4%	22.5%	29.5%
MDR (AG+FQ+3GC)	42.3%	42.9%	56.3%	49.8%	55.2%	55.4%	46.3%
3rd generation cephalosporin	60.8%	67.3%	73.8%	70.7%	68.0%	62.5%	61.4%
Aminoglycoside	54.5%	57.3%	67.6%	54.1%	61.9%	58.6%	50.9%
Fluoroquinolone	50.0%	51.6%	66.5%	61.4%	60.8%	64.1%	57.4%

Source: EARS-Net 2019, CARMIN-ROM 2017

Pseudomonas aeruginosa is an etiologic agent of nosocomial infections in patients with prolonged hospitalization or with severe impairment of anti-infectious barriers, being identified as one of the major causes of nosocomial pneumonia, nosocomial urinary tract infections or systemic infections. Antimicrobial resistance to Piperacillin + Tazobactam, Ceftazidime, Carbapenemases, Aminoglycosides and multidrug resistance to combinations of three or more antibiotics (including Fluoroquinolones), decreased in the last year (table no. VI). As the values remain above 46%, being the highest among the EU/EEA countries, Romania is in the first place for all antibiotics, except for Fluoroquinolone, for which it is in the second place in 2018.

Table no. VI – *Pseudomonas aeruginosa* antimicrobial resistance, in Romania, from 2012 to 2018

	2012	2013	2014	2015	2016	2017	2018
Ceftazidime	51.3%	43.8%	59.1%	65.9%	44.2%	55.9%	46.7%
Carbapenemases	57.8%	60.5%	58.5%	66.3%	51.6%	63.4%	55.1%
Piperacillin + Tazobactam	50.0%	55.0%	62.2%	59.0%	48.8%	53.4%	49.3%
Fluoroquinolone	53.3%	45.2%	55.4%	62.0%	51.7%	62.1%	52.3%
Aminoglycoside	51.1%	51.3%	63.4%	63.3%	50.6%	57.6%	50.7%
MDR (PT+CF+FQ+AG+CP)	48.9%	50.0%	59.6%	63.0%	48.9%	59.1%	49.4%

Source: EARS-Net 2019, CARMIN-ROM 2017

Acinetobacter baumannii is involved in HAI in patients with severe impairment of anti-infectious defense mechanisms. Antimicrobial resistance of carbapenemases, fluoroquinolones, aminoglycosides and combinations thereof, has been maintained at values of more than 74.5% since 2013 (table no. VII). Places occupied by Romania in the hierarchy of the countries with the highest values related to EARS-Net in 2018, as follows: the sixth place for aminoglycosides, the seventh for fluoroquinolones and carbapenemases, the eighth for MDR.

Table no. VII – *Acinetobacter baumannii* antimicrobial resistance, in Romania, from 2012 to 2018

	2012	2013	2014	2015	2016	2017	2018
Carbapenemases	81.5%	85.4%	81.3%	81.5%	85.0%	87.4%	85.3%
MDR (FQ+AG+CP)	50.0%	74.5%	76.9%	76.9%	82.9%	81.3%	77.6%
Fluoroquinolone	88.9%	90.5%	83.7%	82.5%	91.1%	89.1%	88.1%
Aminoglycoside	57.4%	80.3%	77.0%	80.9%	89.5%	83.6%	80.0%

Source: EARS-Net 2019, CARMIN-ROM 2017

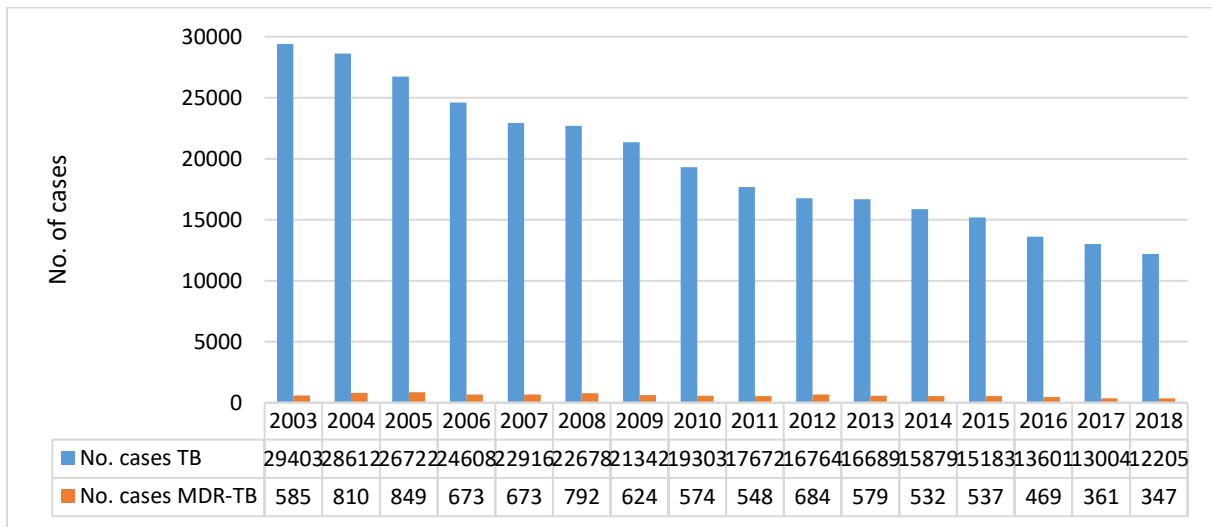
C) Rate of multidrug-resistant tuberculosis

At EU level, data on infectious diseases are recorded by the European Centre for Disease Prevention and Control (ECDC), which created the *Surveillance Atlas of Infectious Diseases*⁴⁰.

Regarding the data on tuberculosis in Romania during 2003-2018, the evolution of the reported cases decreased from 29403 in 2003 to 12205 in 2018.

The evolution of the multidrug resistance cases to the tuberculosis treatment has registered a decreasing trend from 585 in 2003 to 347 in 2018³⁰.

Figure no. 1 - Cases of TB and multidrug resistance to the tuberculosis treatment, in Romania, from 2003 to 2018



Source: ECDC, Surveillance Atlas of Infectious Diseases, 2020

D) Health-care associated infections (HAIs)

In Romania, HAIs represent a much underestimated pathology, with an average incidence calculated from the total number of patients discharged, and based on statistical reports of most hospitals in Romania²⁹. There is a slight increase in the value of the average incidence from 0.25% in 2014, to 0.33% in 2015, to 0.44% in 2016, to 0.53% in 2017²⁹.

Starting with August 2014, a national system for the surveillance of *C. difficile* infections (CDI) has been implemented, which has also led to an increase in the communicated number of health-care associated infections. HAI underreporting is also demonstrated by the lower number of digestive HAIs compared to CDI associated with healthcare.

All the data presented below are related to 2017.

According to the report "Antibiotic consumption, microbial resistance and health care-associated infections in Romania - 2017, CARMIN - ROM 2017"¹⁹, in Romania 10080 cases of CDI treated in hospitals were reported, 8% more than in 2016. The incidence calculated for 2017 was 0.27 per 100 patients discharged, increasing compared to previous years.

The structure of the confirmed cases by the CDI included: health care-associated infections - 77%, infections of community origin - 15% and infections of indeterminate origin - 8%.

The main risk factor for the onset of CDI is the administration of antibiotics, 55%. Other risk factors were: hospitalization in the last year - 57%, administration of gastric antisecretory - 45% and the existence of immune-depressions - 27%.

The most used antibiotics administered during the three months that preceded the onset of CDI were 3rd generation cephalosporin (47%) and fluoroquinolones (31%).

Of the total number of reported CDI cases, a number of 701 were relapses (7%), in which the main associated risk factor was hospitalization in the last year (94%), administration of gastric antisecretory (42%) and immune depressed status (34 %).

Within the HAI sentinel surveillance system, carried out in 10 units of intensive care, the following germs were identified as etiological factors: *Klebsiella* spp - 28%, *Acinetobacter* spp - 23%, *Pseudomonas aeruginosa* - 17%, *Enterococcus* spp - 11%, *Staphylococcus aureus* - 8% and *Escherichia coli* - 8%.

In the 6 surgery wards, the distribution of the etiological factors was as follows: *Klebsiella* spp - 21%, *Acinetobacter* spp - 19%, *Escherichia coli* - 17%, *Pseudomonas aeruginosa* - 14%, *Staphylococcus aureus* - 12% and *Enterococcus* spp - 10%.

Antimicrobial resistance (AMR) in veterinary medicine

The data collected at the national level is transmitted yearly to the European Food Safety Authority (EFSA). Until 2017 all the data were analysed by EFSA and reported in an AMR EU Report, after 2017 in the context of One Health approach the data on AMR in zoonotic and indicator bacteria from humans, animals and food collected by the member states annually are analysed jointly by EFSA and ECDC and reported yearly into a EU Summary Report.

a) Pigs, meat of pigs and meat of cattle^{41,42}

Escherichia coli

In 2015 and 2017, data on antimicrobial resistance in pigs were recorded, for several categories of antibiotics (table no. VIII). The results showed a decrease in antimicrobial resistance to ampicillin, tetracycline, sulfamethoxazole, chloramphenicol and trimethoprim, and an increase for ciprofloxacin and nalidixic acid.

Table no. VIII - *Escherichia coli* antimicrobial resistance, in pigs, in Romania, in 2015 and 2017

	2015	2017
Ampicillin	67.2%	61.2%
Tetracycline	74.2%	60.6%
Sulfamethoxazole	63.4%	55.9%
Chloramphenicol	40.9%	38.8%
Trimethoprim	47.6%	35.3%
Ciprofloxacin	29.6%	34.7%
Nalidixic acid	16.0%	18.2%
Gentamicin	9.0%	5.9%
Azithromycin	7.8%	4.1%
Cefotaxime	1.5%	2.4%
Ceftazidime	1.5%	2.4%
Colistin	0.5%	1.2%
Meropenem	0%	0%
Tygecilin	0%	0%
Cefotaxime + Ciprofloxacin	0.3%	0.6%
ESBL	46.6%	53.7%
AmpC	11.5%	14.5%

Source: EFSA, Antimicrobial resistance in Europe, 2019

Also, in pigs there was an increase in resistance to beta-lactamase with extended spectrum (ESBL) from 46.6% to 53.7% and to AmpC from 11.5% to 14.5%.

The tests for meat of pigs and cattle on the resistance to ESBL and AmpC, in 2015 and 2017, had the following results:

- in meat of pigs: ESBL resistance decreased from 11.1% to 9.7%, and AmpC decreased from 5.5% to 4.7%;
- in meat of cattle: ESBL resistance decreased from 12.5% to 3.4%, and AmpC decreased from 3.1% to 0%.

Salmonella spp.

Data on antimicrobial resistance, for 2015 and 2017, in meat of pigs have decreased.

Table no. IX - *Salmonella spp.* antimicrobial resistance, in meat of pigs, in Romania, in 2015 and 2017

	2015	2017
Ampicillin	47.8%	50.0%
Tetraciclina	34.8%	33.3%
Sulfamethoxazole	30.4%	16.7%
Trimethoprim	21.7%	0%
Ciprofloxacin	8.7%	0%
Chloramphenicol	4.3%	0%
Nalidixic acid	4.3%	0%
Gentamicin	4.3%	0%

Source: EFSA, *Antimicrobial resistance in Europe, 2019*

The decrease was recorded for several categories of antibiotics: tetracycline, sulfamethoxazole, and trimethoprim, ciprofloxacin, chloramphenicol, nalidixic acid and gentamicin (table no. IX). Only in ampicillin there was an increase in antimicrobial resistance.

It is noted that for the other antibiotics not included in the table, for which tests were performed, the values were 0% in both years.

Salmonella Typhimurium

In this type of salmonella, the antimicrobial resistance for meat of pigs, showed an increase in ampicillin (up to 100%) and in sulfamethoxazole, as well as a decrease in tetracycline, trimethoprim, chloramphenicol and gentamicin (table no. X).

Also, the results of the tests performed for the other antibiotics not included in the table, the values were 0% in both years.

Table no. X - *Salmonella Typhimurium* antimicrobial resistance, in meat of pigs, in Romania, in 2015 and 2017

	2015	2017
Ampicillin	85.7%	100%
Tetracycline	42.9%	33.3%
Sulfamethoxazole	28.6%	33.3%
Trimethoprim	28.6%	0%

Chloramphenicol	14.3%	0%
Gentamicin	14.3%	0%

Source: EFSA, Antimicrobial resistance in Europe, 2019

Salmonella Derby

This type of salmonella was tested in meat of pigs only in 2015. The results showed antimicrobial resistance values for ampicillin and sulfamethoxazole of 66.7%, for tetracycline and trimethoprim of 33.3%, and for the rest of antibiotics of 0 %.

b) Broilers, meat from broilers, turkeys, hens⁴³

In this category of poultry the data are related to 2016.

Escherichia coli

Test data for broilers showed high antimicrobial resistance to ciprofloxacin 89.5%, nalidixic acid 85.7%, tetracycline 60.1%, ampicillin 59.6% and sulfamethoxazole 59.4%. Moderate values were 46.5% for trimethoprim, 31.3% for chloramphenicol and 16.4% for gentamicin.

The resistance to extended-spectrum beta-lactamase (ESBL) was 31.2% and to AmpC 34.5%.

In the fattening turkey category, antimicrobial resistance recorded high values for 83.3% ampicillin, 76.7% for ciprofloxacin and chloramphenicol, 73.3% for tetracycline, 70% for sulfamethoxazole and 50% for nalidixic acid. Moderate values were at trimethoprim 40% and gentamicin 20%. The resistance to extended-spectrum beta-lactamase (ESBL) was 56.7%.

In the meat of broilers there were values of the resistance to the beta-lactamase with extended spectrum (ESBL) of 25.1% and to the AmpC of 38.4%.

Campylobacter jejuni

Tests on broilers and fattening turkey revealed high levels of antimicrobial resistance for *Campylobacter jejuni* to three categories of antibiotics: ciprofloxacin, nalidixic acid and tetracycline (table no. XI).

Table no. XI - *Campylobacter jejuni* antimicrobial resistance, in Romania, in 2016

	Broilers	Fattening Turkey
Ciprofloxacin	77.7%	75.0%
Nalidixic acid	74.9%	62.5%
Tetracycline	48.8%	56.3%
Streptomycin	5.6%	0%
Erythromycin	0.3%	0%
Erythromycin + Ciprofloxacin	0.3%	0%

Source: EFSA, Antimicrobial resistance in Europe, 2019

Salmonella spp

The results of the antimicrobial resistance tests for *Salmonella* spp., in broilers and meat from broilers, show high values for ciprofloxacin, sulfamethoxazole, nalidixic acid and tetracycline (table no. XII). Moderate values of ciprofloxacin and nalidixic acid were recorded in laying hens.

Table no. XII - *Salmonella* spp. antimicrobial resistance, in Romania, in 2016

	Broilers	Meat from broilers	Laying hens
Ciprofloxacin	57.6%	61.0%	33.3%
Sulfamethoxazole	51.8%	67.1%	8.3%
Nalidixic acid	45.9%	59.8%	30.6%
Tetracycline	41.8%	67.1%	8.3%
Ampicillin	29.4%	24.4%	2.8%
Trimethoprim	15.9%	9.8%	0%
Gentamicin	7.6%	8.5%	0%
Colistin	5.3%	0%	0%
Tygeciclin	4.1%	0%	0%
Chloramphenicol	1.8%	3.7%	0%

Source: EFSA, Antimicrobial resistance in Europe, 2019

Other types of *Salmonella*

Antibacterial resistance tests were applied to broilers for the following categories: *Salmonella enteritidis*, *Salmonella infantis* and *Salmonella Kentucky*.

The results showed for *Salmonella Kentucky* 100% values for ciprofloxacin, nalidixic acid, tetracycline and sulfamethoxazole, as well as 91.7% for ampicillin and gentamicin.

For *Salmonella infantis* the antimicrobial resistance was registered with the same antibiotics, with values of over 80% (table no. XIII).

In *Salmonella enteritidis* there is a low resistance to ciprofloxacin and colistin, 14.6% and 12.2% respectively.

In laying hens, the situation was as follows:

- for *Salmonella enteritidis* there was resistance to ciprofloxacin and nalidixic acid of 36.4% each;
- for *Salmonella infantis* the resistance was maximum, 100%, to ciprofloxacin, nalidixic acid, tetracycline and sulfamethoxazole.

Table no. XIII – Broilers antimicrobial resistance, in Romania, in 2016

	<i>Salmonella enteritidis</i>	<i>Salmonella infantis</i>	<i>Salmonella Kentucky</i>
Ciprofloxacin	14.6	87.7	100
Colistin	12.2	0	33.3
Ampicillin	9.8	10.8	91.7
Nalidixic Acid	4.9	87.7	100
Tetracycline	2.4	84.6	100
Sulfamethoxazole	2.4	84.6	100
Trimethoprim	2.4	23.1	0
Gentamicin	0	1.5	91.7

Source: EFSA, Antimicrobial resistance in Europe, 2019

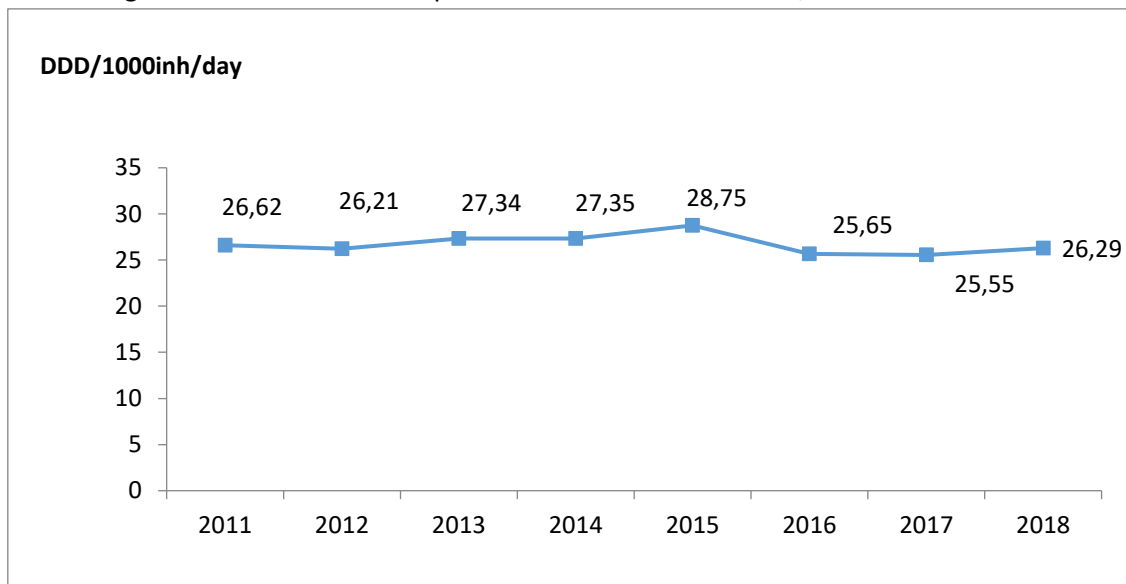
Use of antimicrobial medication

1. Use of antimicrobial drug in human health

The data regarding the use of antimicrobials are found in the sixth Report "Antibiotic consumption, microbial resistance and health care-associated infections in Romania 2017, CARMIN - ROM 2017"²⁹. The data are reported to the ECDC (European Centre for Disease Prevention and Control) in the European Surveillance of Antimicrobial Consumption (ESAC-Net)⁴⁴, an interactive database that provides European reference data on antimicrobial use, both in community and in hospital sector.

The total consumption of antibiotics in Romania, expressed in DDD (Defined Daily Dose) / 1000 inhabitants / day, in the period 2011-2017, varied between 31.54 and 30.32 DDD / 1000 inhabitants / day. The trend was increasing until 2015, after which there was a decrease (Figure no. 2).

Figure no. 2 – Total consumption of antibiotics in Romania, from 2011 to 2018



Source: Report CARMIN – ROM 2018²⁹, ESAC-Net⁴⁴

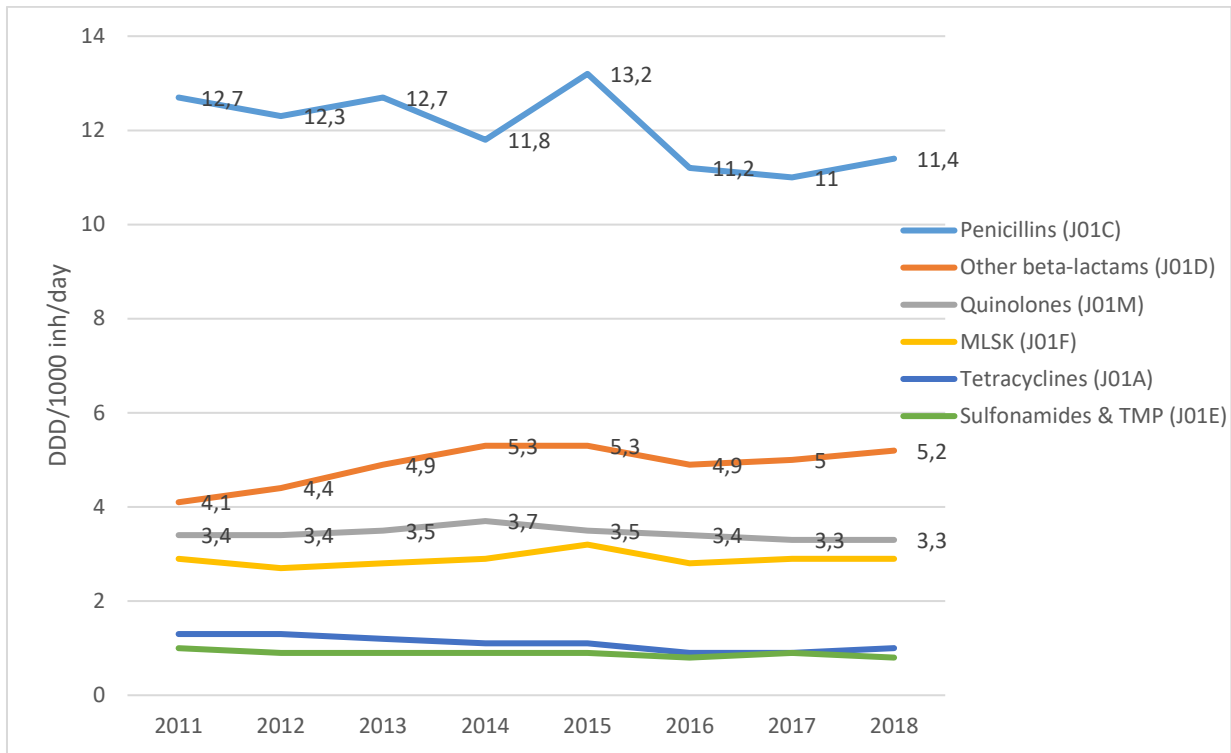
In 2017, the structure of antibiotic consumption at national level highlighted the following²⁹:

- Penicillin were in first place - 52%,
- Other beta-lactamases (cephalosporin, carbapenemases) - 16%,
- Quinolone - 11%,
- Macrolides and lincosamides - 10%,
- "Intestinal" antibiotics (rifaximin, fidaxomicin, nifuroxazide, metronidazole) - 4%,
- Tetracycline - 3%,
- Sulfonamide and trimethoprim - 3%,
- Other antibiotics - 1%.

According to the class of antibiotics (according to the definitions of ESAC-Net), between 2011 and 2017, the consumption at national level for the main categories registered a decreasing trend.

The exception is the category "other beta-lactamases" (cephalosporin, carbapenemases), which has shown an increasing trend (Figure no. 3).

Figure no. 3 – Antibacterial consumption for systemic use (ATC group J01) in Romania, from 2011 to 2018



Source: Report CARMIN – ROM 2018²⁹, ESAC-Net⁴⁴

2. Use of antimicrobial drug in animal health

The European Medicines Agency (EMA) has developed the "European Veterinary Antimicrobial Consumption Surveillance Project" (European Surveillance of Veterinary Antimicrobial Consumption – ESVAC⁴⁵), which collects information on how antimicrobial drugs are used in animals throughout the European Union. This type of information is essential for identifying potential risk factors that could lead to the development and spread of antimicrobial resistance in animals.

The electronic interactive database was created, *ESVAC database*⁴⁶, which allows users to access a summary of ESVAC specific data, including country data or sales of a particular antimicrobial class. Also, in October 2020 was published the annual report *Sales of veterinary antimicrobial agents in 31 European countries in 2018 - Trend from 2010 to 2018*⁴⁷.

In Romania data on sales of antimicrobial VMPs are collected starting 2014 and are reported annually to ESVAC and OIE.

Between 2014 and 2018, in Romania the consumption of antibiotics on the two major categories, tablets and other pharmaceutical forms, expressed in tonnes, can be found in table no. XIV.

Table no. XIV – Consumption of antibiotics (in tonnes) in Romania, from 2014 to 2018

	2014	2015	2016	2017	2018
Tablets (used mainly for pets)	4.21	2.35	3.47	3.26	3.78
Other pharmaceutical forms (used mainly in food producing animals, including horses)	272.82	257.24	265.41	262.88	230.70

Source: EMA, ESVAC database, 2020

The consumption of antibiotics from the second category, other pharmaceutical forms (used in food producing animals, including horses), between 2014-2018, shows a decrease from 109 mg / PCU in 2014 to 82.7 mg / PCU in 2018.

In 2018 tetracycline, penicillin, aminoglycoside and macrolides exceeded 70% of the total consumption. (table no. XV).

Table no. XV – Structure of antibiotic consumption (other pharmaceutical forms) by classes, in Romania, between 2014-2018

	2014	2015	2016	2017	2018
Total mg/PCU	109.0	100.5	85.2	90.1	82.7
Tetracycline	27.45%	26.75%	29.54%	27.86%	30.44%
Penicillin	18.88%	17.65%	17.73%	22.11%	15.24%
Macrolide	13.93%	13.36%	11.88%	20.15%	12.05%
Lincosamide	10.04%	10.33%	11.65%	9.20%	1.84%
Aminoglycoside	8.88%	7.40%	6.55%	6.95%	12.28%
Polymyxin	5.96%	6.39%	5.58%	5.36%	7.75%
Fluoroquinolone	4.82%	6.11%	4.81%	4.80%	7.30%
Pleuromutilin	3.29%	4.49%	3.84%	4.57%	6.33%
Sulphonamide	2.90%	3.17%	3.74%	4.38%	2.19%
Amphenicol	2.60%	2.48%	3.17%	3.01%	3.89%
Cephalosporin 1-2 gen.	< 1%	< 1%	< 1%	< 1%	< 1%
Cephalosporin 3-4 gen.	< 1%	< 1%	< 1%	< 1%	< 1%
Trimethoprim	< 1%	< 1%	< 1%	< 1%	< 1%
Other quinolone	< 1%	< 1%	< 1%	< 1%	< 1%
Others	< 1%	< 1%	< 1%	< 1%	< 1%

Source: EMA, ESVAC database, 2020

National Action Plan in Romania

Governance

At the proposal of the Ministry of Health, it was approved by Government Decision no. 879/2018⁴⁸, establishment of the National Committee for Limiting the Antimicrobial Resistance (NCLAR), a

technical structure, without legal personality, led by a president and a vice-president, under the coordination of the Ministry of Health.

The purpose of the NCLAR is to implement, monitor and evaluate the "National Strategy for the prudent use of antibiotics, limiting the increase of microbial resistance to antibiotics of the human population and animals and preventing the spread of resistant microorganisms at national level".

Collaboration between the human health, veterinary health and animal husbandry will be carried out within this inter-ministerial committee, which will have the responsibility to elaborate and update the national strategy and the national action plan for combating antibiotic resistance.

The NCLAR will be coordinated by the Ministry of Health and will consist of:

- Governing Council, which will have the role of ensuring the collaboration between the structures represented in the Council,
- Expert Group consists of 15 members, appointed for a period of 3 years, who will elaborate recommendations to the Governing Board for the necessary measures in the intervention fields covered by the NCLAR,
- Technical secretariat provided by the General Directorate for Health Care and Public Health within the Ministry of Health, which has the role of coordination, cooperation and communication between NCLAR members.

Governing Council of NCLAR consists of representatives of the following central authorities: Ministry of Health, Ministry of Defence, Ministry of Agriculture and Rural Development, Ministry of Environment, Ministry of Water and Forests, Ministry of Labour and Social Justice, Ministry of National Education, Ministry of Research and Innovation National House of Health Insurance, National Authority for Quality Management in Health, National Institute of Public Health, "Cantacuzino" National Institute for Medical-Military Research and Development, "Prof. Dr. Matei Balș" National Institute of Infectious Diseases, National Sanitary Veterinary and Food Safety Authority, National Agency for Medicines and Medical Devices.

Also, with guest status at meetings NCLAR may be attended by representatives of the College of Pharmacists of Romania, the Medical College of Romania, the College of Veterinarians of Romania, College of Dentists in Romania, representatives of other professional organizations human medical and veterinary representatives of NGOs and patients' associations.

The President of the Governing Council is a Secretary of State within the Ministry of Health, appointed by order of the Minister of Health. The Vice President will be appointed by order of the President of the National Sanitary Veterinary and Food Safety Authority.

The activity of NCLAR will generate measures and recommendations for:

- a) Preventing the extension of the resistance of microorganisms to antimicrobials, by rational use of antibiotics in order to limit the transmission of multidrug-resistant germs;
- b) Optimizing the use of antibiotics in human and veterinary medicine, also using local / national data on microbial resistance;
- c) Dissemination of information regarding the occurrence of variations in antimicrobial resistance notified by the reference microbiology clinics and laboratories by applying the recommendations of the therapeutic guidelines;

- d) Issuing recommendations to the profile institutions on the topics necessary for the training of medical personnel in the human and veterinary field regarding the judicious use of antibiotics, testing of antibiotic resistance and reporting of antibiotic resistance and communication in the field of antimicrobial resistance of microorganisms;
- e) Activities for informing the general public about the judicious use of antibiotics and the risks related to their inappropriate use;
- f) Orientation of medical research towards solving public health problems related to antimicrobial resistance;
- g) Encouraging international cooperation in the field of antimicrobial resistance.

Strategic and operational plan

Strategic direction 1: Improving the legal framework and ensure governance on methods to limit the spread of AMR				
Objectives	Activities	Sub-activities	Responsible entity	Date/period
1.1. Revision of the "One Health" legislative framework	1.1.1. Updating the Government Decision no. 879/2018 regarding the establishment of the National Committee for the Limitation of Antimicrobial Resistance (NCLAR)	1.1.1.1. Write and approve composition, responsibilities and mandates for NCLAR	Ministry of Health	
		1.1.1.2. Writing and approval of the agenda for the mandate period	Ministry of Health	
	1.1.2. Rendering the functionality of the National Committee for the Limitation of Antimicrobial Resistance (NCLAR)	1.1.2.1. Nomination of the new representatives of the institutions from the NCLAR structure	Ministry of Health, National Sanitary Veterinary and Food Safety Authority, Ministry of Agriculture, Ministry of Environment	
		1.1.2.2. Implementing the work agenda for the mandate period	Ministry of Health, National Sanitary Veterinary and Food Safety Authority, Ministry of Agriculture, Ministry of Environment	
1.2. Implementation of the legal framework for systematic and continuous interinstitutional communication	1.2.1. Index the type of data collected for each responsible entity in the field of human health, veterinary health, agriculture and environment.	1.2.1.1. The NCLAR Secretariat requests the list of data from the partner institutions	Ministry of Health	
	1.2.2. Establishing the data of common interest,	1.2.2.1. Interministerial committee (NCLAR)	Ministry of Health	

	communication mode and frequency.	approve the list of date		
		1.2.2.2. Interministerial committee (NCLAR) establish the frequency and manner of data communication (quarter/semester/ annual report)	Ministry of Health	
	1.2.3. Adopting the legal implementation norms	1.2.3.1. Elaboration a proposal for a normative act for the implementation of the data collection and transmission method	Ministry of Health	
		1.2.3.2. Sends to the institutions in the fields of veterinary medicine, agriculture and environment for approval the proposal for the normative act	National Sanitary Veterinary and Food Safety Authority, Ministry of Agriculture, Ministry of Environment	
		1.2.3.3. Approval of the final form of the normative act and its publication	Ministry of Health	
1.3. Adoption of the legal framework for the implementation of AMR and HAIs surveillance, prevention and limitation activities	1.3.1. Updating the specific legislation for AMR and HAIs	1.3.1.1. Reviewing the legislation on hospital financing in view of ensuring a proper budget dedicated to prevention activities	Ministry of Health, National Insurance House	
		1.3.1.2. Reviewing the legislation on HAIs and AMR surveillance in hospitals	Ministry of Health	
	1.3.2. Adopting the law of mandatory standardized reporting on the use and marketing of antibiotics	1.3.2.1. Review of existing legislation	Ministry of Health	
		1.3.2.2. Elaboration of the new law	Ministry of Health	
		1.3.2.3. Approval of the new law	Parliament	
	1.3.3. Establishing the institution responsible for the integration of AMR data in human medicine, veterinary medicine, environment (<i>One Health</i> approach)	1.3.3.1. Elaboration of normative act with nomination of the institution responsible for AMR data integration	Ministry of Health	
		1.3.3.2. Sends to the institutions in the fields of veterinary	National Sanitary Veterinary and Food Safety	

	medicine and environment for approval the proposal for the nomination	Authority, Ministry of Environment	
	1.3.3.3. Approval of the final form of the normative act and its publication	Ministry of Health	
1.3.4. Establishing the institution responsible for adopting health policies to limit the spread of AMR	1.3.4.1. Nomination of the responsible institutions in the human and veterinary medical field	Ministry of Health, National Sanitary Veterinary and Food Safety Authority	
	1.3.4.2. Approval the nominated institutions by normative act	Ministry of Health, National Sanitary Veterinary and Food Safety Authority	
1.3.5. Updating the specific legislation for medical laboratories	1.3.5.1. Reviewing the MoH Order on the functioning of medical laboratories	Ministry of Health	
	1.3.5.2. Establish of the minimum standard equipment for Microbiology compartments/laboratories	Ministry of Health, College of Physicians in Romania	
	1.3.5.3. Implementation of the European system for interpreting of antibiotic susceptibility testing	Microbiology compartments/laboratories	
1.3.6. Establishing microbiology compartments/laboratories with continuous functioning, in 1st rank hospitals, and afterwards in 2nd rank hospitals	1.3.6.1. Elaboration of the list with the 1st and 2nd rank hospitals that have microbiology compartments/laboratories	Ministry of Health	
	1.3.6.2. Approval of the list by Ministry Order	Ministry of Health	
1.3.7. Harmonization of Romanian legislation with EU's recommendations for antibiotic prescription, including on judicious use of antibiotics in hospitals and healthcare settings	1.3.7.1. Elaboration and approval of a new legislative act	Ministry of Health	
1.3.8. Establish surveillance systems for other major	1.3.8.1. Establish the main types of germs to be included in the	Ministry of Health, National Institute of Public Health	

	epidemiological risk germs	surveillance systems reports		
		1.3.8.2. Creation of surveillance systems for selected germs	Ministry of Health, National Institute of Public Health	
		1.3.8.3. Implementation of surveillance systems for selected germs	National Institute of Public Health, hospitals	
	1.3.9. Establishing the institutions responsible for the surveillance of the circulation of antibiotics resistant bacteria in the environment	1.3.9.1. Nomination of the responsible institutions for surveillance of the circulation of antibiotics resistant bacteria in the environment	Ministry of Health, Ministry of Environment	
1.4. Regulation of antibiotic promotion and interactions between the medical staff and antibiotic producers/ traders	1.4.1. Creating a legal framework for the training of the medical staff on interactions with drug producers and traders	1.4.1.1. Review of existing legislation	Ministry of Health	
		1.4.1.2. Elaboration and approval of the new Order of MoH	Ministry of Health	
	1.4.2. Reviewing the laws on transparency of interactions between the medical staff and antibiotic producers and traders	1.4.2.1. Review of existing legislation	Ministry of Health, National Agency for Medicines and Medical Devices	
		1.4.2.2. Elaboration and approval of a new legislative act	Ministry of Health, National Agency for Medicines and Medical Devices	
	1.4.3. Reviewing the regulations on the validation of commercial presentation of antibiotics	1.4.3.1. Review of existing legislation	Ministry of Health, National Agency for Medicines and Medical Devices	
		1.4.3.2. Elaboration and approval of a new legislative act	Ministry of Health, National Agency for Medicines and Medical Devices	
	1.4.4. Shifting to public financing for the CME system	1.4.4.1. Elaboration and approval of a new legislative act	Ministry of Health, College of Physicians in Romania	
	1.4.5. Establishing a maximum number of sponsorships/quantum per person on behalf of pharmaceutical companies	1.4.5.1. Elaboration and approval of a new legislative act	Ministry of Health, Representatives of pharmaceutical companies	
1.4.6. Update, be it periodical or at any time needed, of antibiotic summary of product	1.4.6.1. Elaboration and approval of a new legislative act	Ministry of Health, National Agency for Medicines and Medical Devices		

	characteristics (SmPC) with specific data on antimicrobial resistance in Romania			
Strategic direction 2: Improving the medical staff's knowledge and attitude on HAIs, AMR and on appropriate use of antimicrobials				
Objectives	Activities	Sub-activities	Responsible entity	Date/period
2.1. Elaboration of guidelines and protocols	2.1.1. Surveillance guidelines and protocols for HAIs, AMR and use of antibiotics	2.1.1.1. Development of surveillance guidelines for HAIs, AMR and use of antibiotics	Ministry of Health, National Institute of Public Health	
		2.1.1.2. Development of protocols for diagnosis of HAIs, AMR and use of antibiotics	Ministry of Health, National Institute of Public Health	
		2.1.1.3. Creating a repository with national and international guidelines and protocols for HAIs, AMR and use of antibiotics	Ministry of Health, National Institute of Public Health	
	2.1.2. Standardization of microbiological diagnosis and antibiotic susceptibility testing at a national level	2.1.2.1. Development of guidelines on microbiological diagnosis	Ministry of Health, National Institute of Public Health	
		2.1.2.2. Development of guidelines on antibiotic susceptibility testing	Ministry of Health, National Institute of Public Health	
	2.1.3. Standardization of protocols on infection control at a national level	2.1.3.1. Development of guidelines for infection control	Ministry of Health, National Institute of Public Health	
		2.1.3.2. Development of protocols for infection control	Ministry of Health, National Institute of Public Health	
		2.1.3.3. Creating a repository with national and international guidelines and protocols for infection control	Ministry of Health, National Institute of Public Health	
		2.1.3.4. Dissemination of infection control national/ regional data (quarterly or annual reports)	National Institute of Public Health	
		2.1.3.5. Evaluation and feedback on compliance to guidelines and	National Institute of Public Health	

		protocols (quarterly or annual reports)		
	2.1.4. Elaboration of guidelines and protocols on the use of antibiotics for the main infectious syndromes	2.1.4.1. Development of guidelines for the use of antibiotics for the main infectious syndromes	Ministry of Health, National Institute of Public Health	
		2.1.4.2. Development of protocols for the use of antibiotics for the main infectious syndromes	Ministry of Health, National Institute of Public Health	
	2.1.5. Monitor and control the environmental circulation of clinically relevant drug resistant bacteria	2.1.5.1. Development of guidelines to monitor and control the circulation of clinically relevant drug resistant bacteria in the environment, from microbiology standpoint	Ministry of Health, National Institute of Public Health, Ministry of Environment	
2.2. Specific training modules for the different health care workers categories	2.2.1. Training on the surveillance and control of HAIs, AMR and use of antibiotics	2.2.1.1. Elaboration and use of on-line questionnaires to Identify the training needs for each category (physicians, medical nurses, clinical pharmacists, clinical microbiologist)	Ministry of Health, National Institute of Public Health	
		2.2.1.2. Development of the training curricula	Ministry of Health, National Institute of Public Health	
		2.2.1.3. Deployment of training sessions either face-to-face or on-line	Ministry of Health, National Institute of Public Health	
		2.2.1.4. Update, through CME activities, of knowledge on use of antibiotics by each prescriber	Ministry of Health, National Institute of Public Health	
	2.2.2. Training on the microbiological diagnosis	2.2.2.1. Training on the selective and sequential communication of antibiogram reports in order to avoid using restricted antibiotics as primary intent	Ministry of Health, National Institute of Public Health	
	2.2.3. Training on the HAIs control	2.2.3.1. Elaboration and use of on-line questionnaires to Identify the training needs for each	Ministry of Health, National Institute of Public Health	

	category (physicians, medical nurses, clinical pharmacists, clinical microbiologist)		
	2.2.3.2. Development of the training curricula	Ministry of Health, National Institute of Public Health	
	2.2.3.3. Deployment of training sessions either face-to-face or on-line	Ministry of Health, National Institute of Public Health	
2.2.4. Improvement of the medical staff's knowledge and attitude on the use of antibiotics	2.2.4.1. Deployment of programmes on judicious use of antibiotics in hospitals	Ministry of Health, National Institute of Public Health	
2.2.5 . Education of the medical staff on the importance of vaccination	2.2.5.1 Development of the training curricula, including the behavior insight component, TIP- Tailoring Immunization Programmes	Ministry of Health, National Institute of Public Health	
	2.2.5.2. Deployment of training sessions for trainers	Ministry of Health, National Institute of Public Health	
	2.2.5.3. Deployment of training sessions either face-to-face or on-line, at county and regional level	Ministry of Health, National Institute of Public Health	
2.2.6. Ensuring permanent information of medical staff through the use of computer platforms	2.2.6.1. Creating an on-line platform that allows the access of specialists (existent/in training), at national level, to guidelines and protocols on microbiological diagnosis and AMR	Ministry of Health, National Institute of Public Health	
	2.2.6.2. Creating an on-line platform that allows the access to approved and updated guidelines and protocols on judicious use of antibiotics	Ministry of Health, National Institute of Public Health	
	2.2.6.3. Implementing a website for information and update, in view of improving the medical staff's knowledge on vaccination	Ministry of Health, National Institute of Public Health	

Strategic direction 3: Ensuring that HAIs and AMR data are uniformly, accurately and timely reported					
Objectives	Activities	Sub-activities	Responsible entity	Date/period	
3.1. Revision of the current HAIs and AMR reporting system in view of standardization	3.1.1. Correlating the official database for the reporting of HAIs and AMR with the current surveillance and statistical reporting systems	3.1.1.1. Assessment of current statistical surveillance and reporting systems for HAIs and AMR	Ministry of Health, National Institute of Public Health		
		3.1.1.2. Establish a unique reporting system for HAIs and AMR in accordance with legal requirements	Ministry of Health, National Institute of Public Health		
	3.1.2. Analysis on the compliance to the current reporting system and its content	3.1.2.1. Write an analysis report about the compliance to the current reporting system and its content	Ministry of Health, National Institute of Public Health		
		3.1.2.2. Establish the mechanism for the feedback	Ministry of Health, National Institute of Public Health		
	3.1.3. Developing and implementing a flexible and feasible reporting system for all hospitals and health-care facilities, including the introduction of a reporting system for the use of antibiotics	3.1.3.1. Elaboration and approval of a new legislative act for developing and implementing a HAIs and AMR reporting system for all hospitals and health-care facilities	Ministry of Health, National Institute of Public Health		
		3.1.3.2. Elaboration and approval of a new legislative act for developing and implementing a reporting system for the use of antibiotics in hospitals and health-care facilities	Ministry of Health, National Institute of Public Health		
	3.2. Establishment of an integrated online system for antibiotic resistance, antibiotic use and HAIs data	3.2.1. Establishing the type of necessary data		Ministry of Health, National Institute of Public Health	
		3.2.2. Establishing the reporting formats and the type of generated reports		Ministry of Health, National Institute of Public Health	
3.2.3. Creating the reporting software and the web service					
3.2.4. Creating a rapid alerting system for new multiple drug resistance strains			Ministry of Health, National Institute of Public Health		
3.2.5. Training of the future users			Ministry of Health, National Institute of Public Health		

3.3. Increased quality in the management of AMR and HAIs	3.3.1. Review of management indicators of health-care settings, based on the degree and way of reporting, in view of increasing the data/reporting quality		Ministry of Health	
	3.3.2. Review of quality indicators for medical services related to the use of antibiotics, AMR and HAIs		Ministry of Health	
Strategic direction 4: Communicating the information to the public, transparently, as a way to combat HAIs and AMR				
Objectives	Activities	Sub-activities	Responsible entity	Date/period
4.1. Information and awareness campaign of the general public on the risk of HAIs occurrence and the role of patients and visitors in their prevention	4.1.1. Carrying out/updating some public education campaigns regarding HAIs		Ministry of Health, Counties Directorate of Public Health, National Institute of Public Health	Permanent
4.2. Education campaign for the public on good practices regarding the use of antibiotics	4.2.1 Carrying out/updating education campaigns for the public, on the use of antibiotics, in view of discouraging it when there is no medical recommendation		Ministry of Health, Counties Directorate of Public Health, National Institute of Public Health	Permanent
4.3. Education of the public on the importance of vaccination as one of the most effective public health interventions that also has an essential role in reducing antimicrobial resistance	4.3.1. Carrying out/updating some education campaigns for the public's education		Ministry of Health, Counties Directorate of Public Health, National Institute of Public Health	Permanent
Strategic direction 5: Development of human resources policies and of technical resources adequate to AMR monitoring, at national level				
Objectives	Activities	Sub-activities	Responsible entity	Date/period

5.1. Ensure qualified human resources, in sufficient numbers, trained in clinical microbiology, epidemiology, infection control in order to accommodate the number of beds and addressability	5.1.1 Assessment of the human resource involved		Ministry of Health	
	5.1.2. Estimating the need for human resources		Ministry of Health	
	5.1.3. Identifying solutions for attracting and involving human resources		Ministry of Health	
5.2. Provide the necessary funding for the provision of hospitals/microbiology laboratories, in accordance with the minimum standards for equipment	5.2.1. Assessment of the existing equipment in microbiology laboratories		Ministry of Health	
	5.2.2. Estimating the needs compared to the minimum standards for equipment		Ministry of Health	
	5.2.3. Identifying the financing sources		Ministry of Health	
5.3. Ensure sufficient qualified and dedicated staff in key domains such as the veterinary, agricultural and environment sectors	5.3.1. Assessment of the human resource involved		National Sanitary Veterinary and Food Safety Authority, Ministry of Agriculture, Ministry of Environment	
	5.3.2. Estimating the need for human resources		National Sanitary Veterinary and Food Safety Authority, Ministry of Agriculture, Ministry of Environment	
	5.3.3. Identifying solutions for attracting and involving human resources		National Sanitary Veterinary and Food Safety Authority, Ministry of Agriculture, Ministry of Environment	
Strategic direction 6: Optimizing the use of antibiotics and vaccination in human and veterinary medicine, in agricultural and environment sectors				
Objectives	Activities	Sub-activities	Responsible entity	Date/period
6.1. Limitation of the use of restricted and emergency antibiotics for	6.1.1. Implementing the regulations for antibiotic use in the most common infections, according		Ministry of Health, National Sanitary Veterinary and Food Safety Authority	

current use, under the "One Health" approach	to the guidelines and protocols criteria			
	6.1.2. Implementing the sequential communication programme of antibiogram reports in order to avoid the use of restricted antibiotics as primary intent		Ministry of Health, National Sanitary Veterinary and Food Safety Authority	
	6.1.3. Implementing the WHO list of critically important antimicrobials Implementing the AMEG list on antibiotics used in animals Implementing the CE list on antimicrobials reserved for the treatment of certain infections in humans		Ministry of Health, National Sanitary Veterinary and Food Safety Authority	
	6.1.4. Applying the regulatory control on the sale of antibiotics in human and veterinary pharmacies		Ministry of Health, National Sanitary Veterinary and Food Safety Authority	
	6.1.5. Reorganizing the sub-committees for control of the use of antibiotics within the drug use committees, in each hospital	6.1.5.1. Review of legislation on the control of antibiotic use in hospitals	Ministry of Health	
	6.2. Limitation of the circulation of antibiotics resistant bacteria in the environment (water, sanitation, hygiene - WASH, utilities)	6.2.1. Application of guidelines to monitor and control, from the microbiology standpoint, the circulation of bacteria in the environment		Ministry of Environment, Ministry of Health
6.2.2. Implementation of surveillance of the circulation of antibiotics resistant bacteria in the environment			Ministry of Environment, Ministry of Health	
6.3. Increasing of vaccination rate in	6.3.1. Assessment of the vaccine coverage (for key		Ministry of Health, National Sanitary Veterinary and	

humans and animals	microorganisms) in both human and veterinary medicine		Food Safety Authority	
	6.3.2. Organizing vaccination campaigns		Ministry of Health, National Sanitary Veterinary and Food Safety Authority	

Monitoring & Evaluation plan

The following table shows some examples.

Activities	Sub-activities
1. Improvement of prevention and control of healthcare associated infections	1.1. Monitoring the compliance on hand hygiene, the use of adequate protection equipment, depending on the risk and activity type
	1.2. Monitoring and microbiological control of the circulation of bacteria in hospitals
	1.3. Screening for MDR carriers (nasal, pharyngeal, rectal)
	1.4. Isolating/admitting within the same area of the hospital of patients colonized with MDR, with major dissemination risk, along with allocation of enough, qualified and dedicated medical staff
	1.5. Reorganizing the functional circuits in the hospitals, according to the epidemiological approval; reconstructing certain spaces/circuits
2. Improvement of hygiene processes, disinfection and sterilisation	2.1. Assessment of the responsible medical staff
	2.2. Monitoring the decontamination activities
	2.3. Assessment of the control activities on the quality of decontamination

Bibliography

1. Global action plan for antimicrobial resistance (World Health Assembly document A68/20, 27 March 2015) (http://www.who.int/drugresistance/global_action_plan/en/)
2. Combating AMR and promoting the prudent use of antimicrobial agents in animals (Resolution No. 26). Paris: OIE; 2015 (http://www.oie.int/fileadmin/Home/eng/Our_scientific_expertise/docs/pdf/AMR/A_RESO_AMR_2015.pdf)
3. Status report on antimicrobial resistance C 2015/28). 39th Conference. Rome: FAO; 2015 (<http://www.fao.org/3/a-mm736e.pdf>)
4. United Nation General Assembly during its 71st session - Political Declaration of the high-level meeting of the General Assembly on antimicrobial resistance Statement of financial implications (A/71/PV.24) <https://undocs.org/en/A/RES/71/3>
5. Tripartite Monitoring and Evaluation (M&E) framework for the Global Action Plan on Antimicrobial Resistance (<https://www.who.int/antimicrobial-resistance/global-action-plan/monitoring-evaluation/tripartite-framework/en/>)
6. Resolution WHA68.7. Geneva: WHO; 2015 (https://apps.who.int/gb/ebwha/pdf_files/WHA68/A68_R7-en.pdf)
7. The FAO-OIE-WHO Collaboration, a tripartite concept note. Geneva: WHO; 2010 (http://www.who.int/influenza/resources/documents/tripartite_concept_note_hanoi_0420_11_en.pdf)
8. Regional Committee for Europe Sixty-first session. European strategic action plan on antibiotic resistance (https://www.euro.who.int/_data/assets/pdf_file/0008/147734/wd14E_AntibioticResistance_111380.pdf)
9. WHO – Regional Office for Europe. European strategic action plan 2011-2020. (<https://www.euro.who.int/en/health-topics/disease-prevention/antimicrobial-resistance/policy/european-strategic-action-plan-2011-2020>)
10. European Parliament, the Committee on the Environment, Public Health and Food Safety. Report on the "One Health" European Action Plan Against Antimicrobial Resistance (AMR) <https://eur-lex.europa.eu/legal-content/EN/>
11. Government Decision no. 1028/2014 regarding the approval of the National Health Strategy 2014-2020 and of the Action Plan 2014-2020 for the implementation of the National Strategy, published in the Official Journal of Romania no. 891 of December 8, 2014
12. Government Decision no. 155/2017 regarding the approval of the national health programs for the years 2017 and 2018, published in the Official Journal of Romania no. 222 of March 31, 2017
13. Order of the Ministry of Health no. 377/2017 regarding the approval of the Technical Norms for the realization of the national public health programs for the years 2017 and 2018, published in the Official Journal of Romania no. 223 of March 31, 2017
14. Order of the Ministry of Health no. 1101/2016 regarding the approval of the Norms of supervision, prevention and limitation of the health care-associated infections in the health units, published in the Official Journal of Romania no. 791 of October 7, 2016
15. European Commission. Decision 2012/506 / EU amending Decision 2002/253 / EC establishing case definitions for reporting communicable diseases to the Community network in

- accordance with Decision no. 2119/98 / EC of the European Parliament and of the Council, published in JOCE no 262/2012 <https://eur-lex.europa.eu/legal-content/EN/>
16. Government Decision no. 1414/2009 for the establishment, organization and functioning of the National Institute of Public Health, published in the Official Journal of Romania no. 845 of December 8, 2009
 17. Government Ordinance no. 42/2004 regarding the organization of the sanitary-veterinary and food safety activity, with the subsequent modifications and completions, published in the Official Journal of Romania no. 94 of January 31, 2004
 18. Government Decision no. 1415/2009 regarding the organization and functioning of the National Veterinary Sanitary and Food Safety Authority and its subordinated units, with subsequent modifications and completions, published in the Official Journal of Romania no. 834 of December 3, 2009
 19. Government Decision no. 1156 of December 23, 2013 for the approval of the sanitary-veterinary actions included in the Program of actions for surveillance, prevention, control and eradication of diseases in animals, those communicable from animals to humans, animal protection and environmental protection, identification and registration of cattle, pigs, sheep, goats and equidae, the actions provided for in the Monitoring and Control Program in the field of food safety, as well as their tariffs, published in the Official Journal of Romania no. 8 of January 7, 2014
 20. National Sanitary Veterinary and Food Safety Authority. Activity report 2018. www.ansvsa.ro (accessed December 2019)
 21. European Parliament and European Commission. Regulation (EC) no. 2002/178 establishing the general principles and requirements of the food law, establishing the European Food Safety Authority and establishing procedures in the field of food safety, published in OJ L 31, 1.2.2002 https://eur-lex.europa.eu/legal-content/EN
 22. Institute of Veterinary Hygiene and Public Health. Report on the activity of the Institute of Veterinary Hygiene and Public Health in 2018. www.iispv.ro (accessed December 2019)
 23. Government Decision no. 43 of January 16, 2020 regarding the organization and functioning of the Ministry of Environment, Waters and Forests, published in the Official Journal of Romania no. 55 of January 28, 2020
 24. Government Decision no. 30 of January 18, 2017 regarding the organization and functioning of the Ministry of Agriculture and Rural Development, with subsequent modifications and completions, published in the Official Journal of Romania no. 56 of January 19, 2017
 25. National Institute of Public Health, National Centre for Surveillance and Control of Communicable Diseases. Methodology of surveillance in the sentinel system of infections associated with healthcare and microbial resistance. <http://www.cnscbt.ro/index.php/metodologii/infectii-nosocomiale>
 26. National Institute of Public Health, Regional Centre of Public Health Bucharest. Methodology for applying the current prevalence study of healthcare-associated infections (PPS) 2017. http://www.cnscbt.ro/index.php/metodologii/nosocomiale_infections/711-methodology-of-application-pps-2017
 27. National Institute of Public Health. Analysis of the evolution with Clostridium difficile in hospitals in Romania, 2018. <http://www.cnscbt.ro/index.php/analiza-date-supraveghere/infos-nosocomiale-1/1225-analiza-evolutiei-infectiei-cu-clostridium-difficile-in-spitalele-din-romania-2018/file>

28. National Institute of Public Health. Methodology for monitoring Clostridium difficile infection (ICD) <http://www.cnscbt.ro/index.php/metodologii/infectii-nosocomiale/1281-metodologie-icd-2019/file>
29. Popescu G.A., Șerban R., Niculcea A, Pistol A. Antibiotic consumption, microbial resistance and infections associated with healthcare in Romania - 2018, CARMIN - ROM 2018 <http://www.cnscbt.ro/index.php/analiza-date-supraveghere/infectii-nosocomiale-1/1309-consumul-de-antibiotice-rezistenta-microbiana-si-infectii-asociate-asistentei-medicale-nosocomiale-in-romania-2017/file>
30. National Institute of Public Health, National Center for Health Assessment and Promotion. Global multi-annual campaign "Save lives: hand hygiene!", May 5, 2019, "Clean care for all - is in your hands", Situational analysis. <http://insp.gov.ro/sites/cnepss/wp-content/uploads/2019/04/Analiza-situatie-igiena-mainilor-2019.pdf>
31. National Institute of Public Health, National Center for Health Assessment and Promotion. "European Antibiotic Information Day - ZEIA - 2019. Situation analysis". <http://insp.gov.ro/sites/cnepss/wp-content/uploads/2016/01/1.-Analiza-de-situatie-ZEIA-2019-final.pdf>
32. Order of the NSVFSA President no. 35/2016 regarding the approval of the Methodological Norms for the application of the Program of actions for surveillance, prevention, control and eradication of diseases in animals, those transmissible from animals to humans, protection of animals and environmental protection, identification and registration of cattle, pigs, sheep, goats and equidae, as well as the Methodological Norms for the application of the Monitoring and Control Program in the field of food safety, published in the Official Journal of Romania no. 303 of April 20, 2016
33. European Commission. Decision 2013/652 / EU on the monitoring and reporting of antimicrobial resistance of zoonotic and commensal bacteria, published in OJ L 303, 14.11.2013 <https://eur-lex.europa.eu/legal-content/EN/>
34. European Parliament and European Council. Directive 2003/99 / EC on the monitoring of zoonosis and zoonotic agents, published in OJ L 325, 12.12.2003 <https://eur-lex.europa.eu/legal-content/EN/>
35. National Sanitary Veterinary and Food Safety Authority. National guide to the prudent use of antimicrobials in veterinary medicine. www.ansvsa.ro (accessed December 2019)
36. European Commission. Communication no. 2015 / C299 / 04 - Guidelines for the prudent use of antimicrobial substances in veterinary medicine. OJ C 299, 11.09.2015 <https://eur-lex.europa.eu/legal-content/EN/>
37. National Sanitary Veterinary and Food Safety Authority. Sampling of food products for microbiological testing. <http://www.ansvsa.ro/proceduri/> (accessed December 2019)
38. European Center for Disease Prevention and Control, European Antimicrobial Resistance Surveillance Network (EARS-Net). <https://www.ecdc.europa.eu/en/about-us/partnerships-and-networks/disease-and-laboratory-networks/ears-net>
39. European Center for Disease Prevention and Control. Surveillance of antimicrobial resistance in Europe, 2018. <https://www.ecdc.europa.eu/en/publications-data/surveillance-antimicrobial-resistance-europe-2018>
40. European Centre for Disease Prevention and Control. Surveillance Atlas of Infectious Diseases - Tuberculosis. <https://atlas.ecdc.europa.eu/public/index.aspx?Dataset=27&HealthTopic=4>

41. European Food Safety Authority. Antimicrobial resistance 2017, interactive pages. <http://www.efsa.europa.eu/en/interactive-pages/AMR-Report-2017>
42. European Food Safety Authority. Antimicrobial resistance 2015, interactive pages. <http://www.efsa.europa.eu/en/interactive-pages/AMR-Report-2015>
43. European Food Safety Authority. Antimicrobial resistance 2016, interactive pages. <http://www.efsa.europa.eu/en/interactive-pages/AMR-Report-2016>
44. European Centre for Disease Prevention and Control. European Surveillance of Antimicrobial Consumption (ESAC-Net). <https://www.ecdc.europa.eu/en/antimicrobial-consumption/surveillance-and-disease-data/database>
45. European Medicines Agency (EMA), Veterinary Regulatory. European Surveillance of Veterinary Antimicrobial Consumption - ESVAC. <https://www.ema.europa.eu/en/veterinary-regulatory/overview/antimicrobial-resistance/european-surveillance-veterinary-antimicrobial-consumption-esvac>
46. European Medicines Agency (EMA) - ESVAC database. <https://bi.ema.europa.eu/analyticsSOAP/saw.dll?Dashboard>
47. European Medicines Agency (EMA). Sales of veterinary antimicrobial agents in 31 European countries in 2017 – Trend from 2010 to 2017. <https://www.ema.europa.eu/en/documents/report/sales-veterinary-antimicrobial-agents-31-european-countries-2017en.pdf>
48. https://www.ema.europa.eu/en/documents/report/sales-veterinary-antimicrobial-agents-31-european-countries-2018-trends-2010-2018-tenth-esvac-report_en.pdf
49. Government Decision no. 879/2018 regarding the establishment of the National Committee for the Limitation of Antimicrobial Resistance, published in the Official Journal of Romania no. 979 of November 20, 2018