

Antimicrobial stewardship in Central Eastern European countries

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Antimicrobial stewardship in Austria

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Country-specific information

Austria is a landlocked country of approximately 8.9 million inhabitants in Central Europe. As a federal republic, Austria comprises nine autonomous federal states, also referred to as provinces (*Länder*). In Austria, public health services are a federal matter in terms of legislation. Patient care is the responsibility of the individual provinces. The Federal Ministry of Health has the mandate to formulate quality standards for hospitals. Hospitals are operated by provinces, municipalities, social insurance companies, private companies and religious groups. In 2020, there are a total of 982 registered health care institutions; 270 of these institutions (65,000 beds in total) provide general acute care. The principle of statutory health insurance, combined with the co-insurance of children and non-working partners, ensures that 99% of the entire population enjoy health insurance cover.

Antimicrobial stewardship programme

In 1998, “Guidelines for the Development of an Antibiotic Culture in the Hospitals” were published on the initia-

tive of the Ministry of Health. Based on local experience, the project “ABS [antibiotic stewardship] International-Implementing Antibiotic Strategies for Appropriate Use of Antibiotics in Hospitals in Member States of the European Union” was started in September 2006. In nine states, a training programme for national ABS trainers was implemented and standard templates for ABS tools (antibiotic list, guides for antibiotic treatment and surgical prophylaxis, antibiotic-related organisation) and valid process measures, as well as quality indicators for antibiotic use were developed. Under the guidance of the Ministry of Health, a National Action Plan on Antimicrobial Resistance (NAP-AMR) was developed with the objective of achieving a lasting reduction in the emergence and spread of antimicrobial resistance. The plan includes diagnosis of infectious diseases, surveillance of antibiotic resistance (AURES report), antibiotic consumption in hospitals and ambulatory care, guidelines for hospital hygiene (PROHYG 2.0) and veterinary reports on antibiotic consumption and resistance. Once a year, all the key players gather for a one-day conference, the “Antibiotic Awareness Day”, under the patronage of the Ministry of Health.

Providing surveillance data on nosocomial infections, the performance of hand hygiene and on the consumption of antibiotics is a legal obligation under the NAP-AMR. There are two major surveillance systems offered by scientifically recognised institutions: the Austrian Nosocomial Surveillance System (ANISS), a subgroup of the European Hospitals in Europe for Infection Control through Surveillance (HELICIS) system, and the German-based *Krankenhaus* (hospital) Infection Surveillance System (KISS). The latter offers tools for surveillance of antibiotic consumption and 18 of the acute care hospitals participate in the KISS system. The data are generated at ward level according to ATC codes and can be analysed accordingly. A comparison between anonymised hospitals according to the size of the institution and the degree

of care provided is possible in real time. The interpretation of the data with regard to recent resistance patterns and markers of overuse of antibiotics, such as the rate of *Clostridioides difficile* infection, is a duty of the ASP team. In 2020, an initiative of the Ministry of Health was started to establish a similar system for the outpatient sector in Austria.

Data on antimicrobial consumption

The report on antimicrobial resistance in Austria (AURES report) presents the yearly consumption of antibiotics in the field human medicine and is based on prescription data, as provided by the *Hauptverband der österreichischen Sozialversicherungsträger* (Organisation of Austrian Social Security), and on sales data, as provided by IQVIA™ (formerly IMS Health *Marktforschung GmbH*). AURES is published by the Austrian Ministry of Health. Based on sales data, the systemic overall consumption of antibiotics in the field of human medicine in Austria in 2018 amounted to 70,271 kg of active ingredients, with 67% of this being prescribed by registered practitioners. The consumption density in Austria in 2018, considering the newly defined daily doses (DDD) for certain antibiotics by the WHO, was 15.53 DDD/1,000 inhabitants per day based on sales data compared with 10.36 DDD/1,000 inhabitants per day based on the consumption data of the *Sozialversicherungsträger*. Compared with 2017, the prescriptions of antibiotics decreased from 17.3 to 15.2 per 10,000 inhabitants per day. Penicillins (J01C) accounted for the largest portion of overall consumption with 42.2% (6.99 DDD/1,000 inhabitants per day). In the sector of registered practitioners, penicillins (J01C) accounted for the highest consumption (42.8%; 5.7 DDD/1,000 inhabitants per day), followed by the group of macrolides, lincosamides and streptogramins (J01F; 21%; 2.8 DDD/1,000 inhabitants per day). The same holds for the hospital sector, with a consumption of penicillins (J01C) of 15.3 DDD/100 bed days per year (38.3% of the overall consumption in this sector). The second most consumed group of antibiotics in this sector were the cephalosporines (J01D) with 10.6 DDD/100 bed days per year (portion of overall consumption in this sector: 26.4%).

Monitoring of antimicrobial consumption in hospitals and in outpatient care

In Austrian hospitals, antibiotic stewardship programmes (ASPs) vary according to the size and the needs of the respective facility. The ASP team includes at least one physician, preferably an infectious disease consultant or a person with higher qualification in treatment of infectious diseases, a microbiologist and a pharmacist; relevant people from various clinical departments can be included. The ASP team reports directly to the hospital management. The ASP team is led by either the physician or the pharmacist; the ASP team leader is in charge of the group's management and the communication of the outcome to the hospital management. The responsi-

bility for the initiation of an ASP and for providing staff and financial resources lies with the hospital management. Scientific societies, such as the Austrian Society for Antimicrobial Chemotherapy (ÖGACH), offer educational programmes for developing the ASP qualifications of physicians, microbiologists and pharmacists. Training topics are management knowledge, tools for establishing antibiotic lists, treatment guidelines, performing consumption control, audits, giving feedback to the physicians and how to report the results. Adherence to the treatment guidelines is audited yearly. Data on antibiotic consumption are available for 18 participating hospitals, in detail at ward level and at the level of ATC groups.

Antimicrobial stewardship in Bulgaria

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Country-specific information

The Republic of Bulgaria, situated in Southeastern Europe, is a former socialistic country with a well-developed health care system. Bulgaria has 7,900,000 inhabitants (2019 census) and an area of 111,000 km². It consists of 28 administrative districts. The Ministry of Health (MoH) implements health policies and attempts to undertake democratic reforms, despite the frequent change of ministers. At present, out of a total of 360 hospitals with 50,519 beds, 65 are state owned, 115 are private and 280 are operated by the districts. The number of physicians is 29,612, higher than the EU average, and the number of nurses and other medical specialists (46,491) is gradually decreasing. Bulgaria's GDP per capita of USD 24,595 (PPP, 2019) is lower than the EU average of USD 44,369 (PPP, 2019); health care expenditure in Bulgaria is 8.1%, which is also lower than the EU average of 10.0%. The National Health Insurance Fund covers the majority of health care services, but a significant part remains non-reimbursed. Bulgarian patients pay 65% of the price of antibiotic themselves. The Bulgarian Drug Agency regulates and licenses antibiotics. According to national law, antibiotics in Bulgaria can be prescribed only by physicians and are sold by pharmacies only upon presentation of a prescription.

Antimicrobial stewardship

The first National Programme on Rational Antibiotic Policies was approved in 2001, with a second edition in 2004. A reference laboratory for antimicrobial resistance (AMR) control within the National Centre for Infectious and Parasitic Diseases (NCIPD) was created, and a national AMR surveillance programme entitled BulSTAR was implemented. Active participation in international organisations and scientific projects such as APUA, ESCMID (ARPAC, EARSS, ESAC) and others was effective and helpful. The MoH issued the standards “Microbiology” and “Prevention and control of nosocomial infections” and various pharmaco-therapeutic guidelines. In recent years, promoting antimicrobial stewardship (AMS) has become more active through education in universities and colleges, scientific events, experts’ opinions presented in the mass media, celebration of 18 November (European Antibiotic Awareness Day), discussions with the parliamentary commission on health care and activities of patients’ organisations. Practical guidelines for rational antibiotic use in ambulatory care were issued by the NCIPD and controls on the OTC sale of antibiotics were strengthened. Every hospital has an antibiotic policy programme and an antibiotic team; hospital AMS activities are mandatory and required for the process of hospital accreditations. The majority of hospitals practises the AMS strategy of pre-authorisation. Participation in point prevalence studies (e. g. Global PPS) allows benchmarking. In recent years, efforts were focused on preparing a national plan for AMS. Several strategic tasks were formulated: awareness of AMR through education; increasing research; strengthening infection control; promotion of AMS and control of antibiotic consumption; development of infectious disease diagnostics. The plan is still undergoing discussion within the MoH.

Data on antimicrobial consumption

Antibiotic consumption of the ATC group JO1 in Bulgaria during the past 10 years was near the average for EU/EEA countries (ESAC-Net, 2019). Total consumption in 2018 was 21 DDD/1000 inhabitants/day, a 2.1% increase since 2009. In the community, a relatively low usage of penicillins (J01C; 5.5 DDD/1000/d) was recorded, while higher prescriptions of other β -lactams (J01D; 4.4), macrolides (MLS; J01F; 4.0) and quinolones (J01M; 2.8) was noticed, thus forming an increase of 10.9% of the indicator “broad-spectrum penicillins + macrolides + quinolones vs. narrow-spectrum penicillins + erythromycin”. In hospitals, the picture was similar: total ATC group JO1 was estimated at 1.61 DDD/10,000/d; penicillins accounted for only 7%, while the majority of prescribed antibiotics were cephalosporins and β -lactams + inhibitor. Higher use of antibiotics mirrors the spread of multiresistant strains, particularly old ESBL producers and the emergence of carbapenem-resistant isolates. An increasing trend was reported in both the ambulatory and hospital

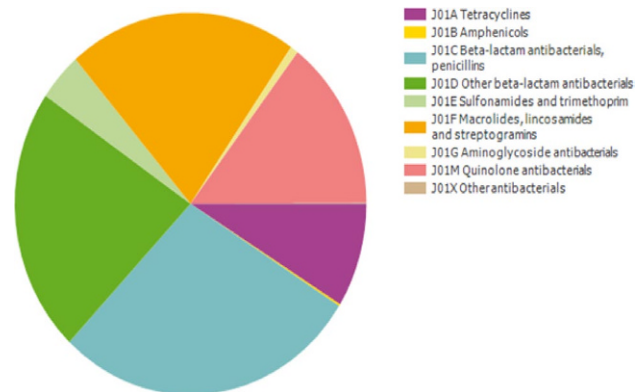


Fig. 1. Distribution of antibacterials for systemic use in Ambulatory care in Bulgaria, 2019

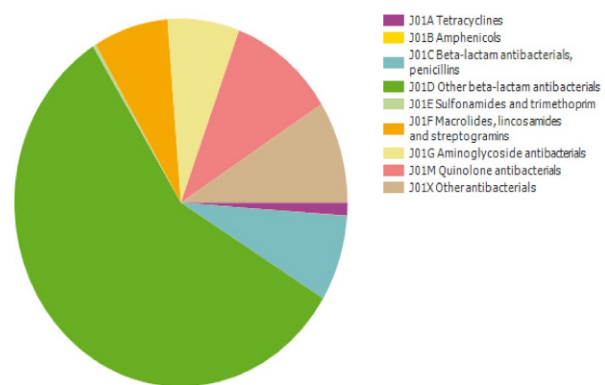


Fig. 2. Distribution of antibacterials for systemic use in Hospital care in Bulgaria, 2019

sectors, the latter also including resistance to carbapenems and polymyxin (colistin).

Monitoring of antimicrobial consumption in hospitals and in outpatient care

Antibiotic consumption data in both the community and hospital sectors is monitored by the NCIPD. In 2019, it was 19.0 and 1.7 DDD/1,000 inhabitants/day, respectively. The distribution of different classes of antibiotics for systemic use shows a particularity: a small proportion of penicillins but high use of other β -lactams (combinations β -lactam + inhibitor and cephalosporins; Fig. 1 and 2; ESAC-Net, ECDC, 2020).

One reason is the shortage of certain antibiotics such as penicillins and others. In hospitals, generic inexpensive ceftriaxone was overused, despite the experts’ recommendations. Due to a reduced number of isolation rooms and non-regular screening of risky patients for resistant organisms, problem strains continue to spread, requiring more and expensive antimicrobials.

In conclusion, some improvement in AMS was achieved, although more government involvement and improved infection control is required.

Antimicrobial stewardship in Croatia

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Country-specific information

Croatia is a parliamentary republic with approximately 4.06 million inhabitants and a territory covering 56,594 km². Administratively, Croatia is divided into 20 counties and the capital city of Zagreb. The Croatian health care system is primarily determined by the Health Care Act, under which the Ministry of Health has the mandate to develop the National Health Care Strategy, which names key strategic measures in providing health care. Hospitals are operated by the state, counties, municipalities and rarely by private companies. There are 350.5 curative care beds per 100,000 inhabitants and nearly 100% of the population is covered by public health insurance. Antibiotics are reimbursed in full or partially and are prescription-only medicines.

Data on antimicrobial resistance

The first nationwide activity directed towards more prudent use of antibiotics was implemented by the Croatian Committee for Antibiotic Resistance Surveillance (CCARS) at the Croatian Academy of Medical Sciences in 1996. This network regularly provides yearly updates on antimicrobial resistance (AMR) in the most frequent pathogens at regional and national levels with >90% population coverage. In 2003, the network was strengthened by the establishment of the Ministry of Health Reference Centre for Antibiotic Resistance Surveillance, which is responsible for providing external quality control for antibiotic sensitivity testing and retests isolates with an unusual phenotype collected within the surveillance network. The network has also participated in the European Antimicrobial Resistance Surveillance Network (EARSS/EARS-Net) since 1999 and in the Global Antimicrobial Surveillance System (GLASS) since 2018. Providing data for the national AMR surveillance network was voluntary to begin with, but since the country's accession to the European Union has been mandatory for all governmental institutions. The AMR network meets twice a year and provides the framework for the standardisation of sensitivity testing methods and the interpretation of laboratory results as well as for monitoring the trends in resistance and early notification of pathogens with new resistance mechanisms. The network provides guidance for monitoring and reporting resistance in local settings

and encourages national and international collaboration.

Data on antimicrobial consumption

Croatia began collecting internationally comparable antimicrobial consumption data in 2001, after joining the European Surveillance of Antimicrobial Consumption Network (ESAC/ESAC-Net). Data are collected at the fifth and published at the fourth and third level of the Anatomical Therapeutic Chemical (ATC) classification. Data cover >90% of the Croatian population and are presented in a yearly publication together with antimicrobial resistance data, separately for the hospital and ambulatory sectors. Wholesale and hospital pharmacy data are used in parallel to analyse hospital consumption, and wholesale and insurance company data are used to analyse outpatient use. Consumption trends for individual hospitals are analysed within a group of hospitals with similar clinical activity, with county hospitals being the most homogeneous group. Periodically, point prevalence studies on the incidence of healthcare-associated infections (HAI) and antibiotic use are conducted following the European Centre for Disease Prevention and Control (ECDC) HAI-Net initiative.

Antimicrobial stewardship programme

Although many activities related to rationalising antibiotic use have been in existence since the 1990s, it was only after establishing an intersectoral coordination mechanism (in Croatian: *Interdisciplinarna sekcija za kontrolu rezistencije na antibiotike*, ISKRA) in 2006 that all these activities became coordinated at the national level. ISKRA is a joint platform for the Ministry of Health, Ministry of Agriculture and Ministry of Science and Education and has set up a national programme for controlling AMR, which is updated every 5 years. In the human medicine sector, ISKRA combines representatives from different professional societies of the Croatian Medical Association and institutions interested in AMR. Under the coordination of ISKRA, national AMR and antibiotic consumption data are used to develop clinical guidelines and conduct public campaigns on the prudent use of antibiotics. Every year since 2008, the European Antimicrobial Awareness Day, and since 2015, the World Antimicrobial Awareness Week, have been marked by a national symposium and by many educational activities targeting health care workers and the general public. The major update in the current National AMR programme focuses on strengthening antimicrobial stewardship (AMS) activities at institutional level. The establishment of formal AMS teams and development of AMS programmes in hospitals is recommended. National strategy also lists as priorities improvement of education on prudent antimicrobial use and AMS components for undergraduate and postgraduate students, and strengthening the consulting role of infectious diseases, clinical microbiology and clinical pharmacy specialists. A working group was

recently established at the Ministry of Health to promote the establishment and activities of AMS teams in hospitals.

Antimicrobial stewardship (ABS) in the Czech Republic (CZ)

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Country-specific information

In the Czech Republic (CZ), the healthcare system is based on general health insurance, which is obligatory. Health care facilities are operated by the state and the regions, and some are private (mostly in primary and ambulatory care). Financing of antimicrobials is mostly covered by the health insurance budget. Ambulatory prescriptions are co-financed by patients.

Antimicrobial resistance (AMR) of community pathogens is at a low (pneumococci) or medium (*Escherichia coli*) level. AMR in hospitals is at a high level, especially with regard to gram-negative pathogens (except carbapenem resistance). Prevalence of methicillin-resistant *Staphylococcus aureus* (MRSA) is at a medium level, while the occurrence of vancomycin-resistant enterococci (VRE) is increasing.

Antibiotic use (ABU) in the community is generally low in a European context, although detailed consumption data have not been available since 2015. According to results of the ECDC point prevalence survey on health care-associated infections and antibiotic use in hospitals 201–2017, antibiotic use in CZ hospitals is low compared with other EU/EEA countries. In surgery, overuse of antimicrobial prophylaxis is frequent.

ABS-related activities by the state have a long history in the Czech health care system. They are managed by so-called antibiotic centres. Current ABS activities are covered by a national antibiotic programme.

Current ABS activities

ABS activities in hospitals are operated as hospital ABS programmes, with defined standards and measurable elements. Essential programme functions include surveillance activities (AMR, ABU and consumption), local antibiotic lists, local ABU guidance documents, ABU consulting and supervision, measuring the quality of treatment and prophylaxis in clinical practice with effective feedback to prescribers and the systematic training of prescribers. Skilled and well-trained profession-

als with dedicated competencies and allocated working time are responsible for programme management. However, insufficient personnel capacity and remaining organisational problems persist. ABS activities in primary and ambulatory care are largely missing, which poses a challenge. The involvement of the insurance system is necessary in order to provide feedback to prescribers and to establish proper motivation for rational antibiotic use. Antibiotic centres support good diagnostic and prescribing practice, but many pitfalls and barriers are present. A specific issue in this segment of care is the availability of professional guidelines for antibiotic treatment, which are relatively fragmented and difficult to coordinate. There is a variety of conflicts of interest, including the marketing-motivated influence of the pharmaceutical industry.

National antibiotic programme (NAP-CZ)

The national antibiotic programme (NAP-CZ) was established by the government in 2009. It is managed by the Ministry of Health in cooperation with other ministries (e.g. agriculture, environment, education). It defines the strategy, infrastructure, organisation and functions of ABS-related activities focused on the rational antibiotic use and AMR prevention and control at national, regional and local levels. Concrete activities are covered by particular action plans: Action plan of the national antibiotic programme 2011–2023 (in Czech), available at: http://www.szu.cz/uploads/AP_NAP_2011_2013.pdf; Action plan of the national antibiotic programme 2019–2022 (in Czech), available at: <https://www.mzcr.cz/wp-content/uploads/wepub/7725/36701/Ak%C4%8Dn%C3%AD%20pl%C3%A1n%20NAP%202019-22.pdf>. Unfortunately, however, most programme priorities remain formal and without significant impact on daily practice.

Education and training

An ABS-related training course was developed in 2019. It is a five-day training module that focuses on implementing the hospital antimicrobial stewardship programme (ABS infrastructure, activities, functions and tools at local level). This training is independent of the pharmaceutical industry and organised by public health institutions as a non-profit and low-cost activity.

International cooperation

The Czech Republic is currently participating in several public health ABS-related networks, programmes and projects (EARS-Net, ESAC-Net and HAI-Net covered by the ECDC ARHAI programme, EU JAMRAI project).

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Antimicrobial stewardship in Estonia

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Country-specific information

Estonia is a Northern European country with a population of 1.34 million and with health care covered by a single Estonian Health Insurance Fund. Primary care is provided by general practitioners. Secondary and tertiary care is given by publicly or privately owned hospitals. Antibiotics, except for topical formulations, are exclusively prescription medicines.

Antimicrobial stewardship programme

The Communicable Diseases Prevention and Control Act and the Regulation of the Ministry of Social Affairs on Surveillance and Prevention of Healthcare-Associated Infections in health care settings mandates infection prevention and control (IPC) teams in all Estonian hospitals. The IPC teams are responsible for hospital infection control, antimicrobial stewardship, development of hospital-specific IPC and treatment guidelines, surveillance and internal training. Each hospital has its own antibiotic treatment guidelines. There are no national guidelines on antimicrobial treatment. Larger hospitals also have a list of antimicrobials with restricted use that require approval by infectious disease specialists. The Estonian Society for Infectious Diseases has developed treatment guidelines for common ambulatory infections that guide general practitioners. A steering committee for antimicrobial resistance (AMR), One Health, has been formed at the Ministry of Social Affairs to cover AMR issues in human and veterinary medicine and in the environment. There is an ongoing 3-year strategic research & development project (RITA) which focuses on the emergence of AMR in Estonia and aims at determining the main transmission routes of AMR and filling gaps in knowledge.

Data on antimicrobial consumption

Since the mid-1990s, antimicrobial utilisation has been monitored using the defined daily dose (DDD) methodology. All wholesalers report to the State Agency of Medicines on a yearly basis. The DDD/1,000 inhabitants/year is collected in units (packages) and in costs.

The DDD/1,000 inhabitants/day of systemic antibacterials in the community setting was 11.97 in 2019. Al-

though there have been no remarkable changes in the total consumption of antibacterials in the community during 2008–2018, the spectrum of prescribed antibacterials has changed. The number of prescriptions for broad-spectrum penicillins is decreasing, and for penicillin and beta-lactamase inhibitor combinations this is increasing. The use of cephalosporins has slightly increased while consumption of quinolones has decreased. In hospitals, antimicrobial use was 1.56 DDD/1,000 inhabitants/day in 2018 (EU average 1.79). Broad-spectrum antibiotics accounted for 26.4% of the total use of antibiotics; the EU average is 41.3% (2016–2017 European Centre for Disease Prevention and Control, ECDC point prevalence survey).

Monitoring of antimicrobial consumption in hospitals and in outpatient care

All regional, central and some general hospitals measure the total DDD consumption over 100 inpatient days at least annually and IPC teams provide ward-disaggregated feedback to the different departments. In the ECDC point prevalence survey 2016–2017, 23 Estonian acute care hospitals with 4,220 patients participated. The prevalence of antimicrobial use was 25.1% (95% CI: 21.2–29.0).

AMR surveillance

Twelve diagnostic microbiology laboratories perform antimicrobial sensitivity testing in Estonia. For AST, the guidelines of the European Committee on Antimicrobial Susceptibility Testing are applied. There is no formal reference laboratory for AMR in human medicine. The Health Board is responsible for monitoring AMR in human medicine. Laboratories and clinicians are obliged to report information on communicable diseases, outbreaks and multidrug-resistant organisms in invasive infections through an electronic notification system. Data on AMR in invasive bacterial isolates are available from EARS-Net. However, no continuous monitoring is performed for AMR in outpatients.

Antimicrobial stewardship in Hungary

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Country-specific information

Hungary is a republic of 9.7 million inhabitants, consisting of 19 counties and the capital city, Budapest. The country has a statutory health insurance system. There are approximately 160 publicly financed hospitals with

69,000 beds (7.1 hospital beds per 1,000 inhabitants). Of these, 91 facilities provide acute inpatient care with 42,000 beds. The health system is highly centralised, with the majority of publicly financed hospitals being run by the state, and the government regulating the whole sector.

Antimicrobial stewardship programme

The Ministry of Health Decree No. 20/2009 (VI.18.) on the prevention of health care-associated infections (HAI), minimum professional requirements and supervision of these activities stipulates the operation of infection control and antibiotic committees (ICACs) at hospital, county and national levels from 2009 onwards. Hospital ICACs are a multidisciplinary advisory forum reporting to the hospital management and chaired by the hospital director. Their members include the medical director, a hospital epidemiologist, an infectious disease specialist, a microbiologist, a pharmacist and representatives of clinical specialities. Among other stewardship activities, they monitor and evaluate the appropriateness of antibiotic use at the hospital level. They report on their activities to county-level ICACs, which in turn report to the Chief Medical Officer.

To address the growing antimicrobial resistance (AMR) problem in Hungary, an evidence brief for policy entitled “Promoting the appropriate use of antibiotics to contain AMR in human medicine in Hungary” was developed by Hungarian experts and published by the World Health Organization (WHO) Regional Office for Europe in 2018. The document proposed three policy options for the improvement of antibiotic prescription practices, the first of which involves developing a national antimicrobial stewardship programme (ASP), complemented with evidence-informed guidelines on the diagnosis and treatment of common infections.

Methodological guidelines for the development of ASPs at national and provider level, both in in- and outpatient care, were published by the “Methodological development of the Hungarian health care system” project in 2018.

In 2019, the national ICAC developed an “Action plan to strengthen infection prevention and control and to combat AMR in human medicine in Hungary”, while the above-mentioned project developed a “One Health National Action Plan against AMR”. Both documents, though not yet approved by the government, propose antibiotic stewardship activities in a wide range of areas, following the five objectives of the WHO global action plan on AMR.

Data on antimicrobial consumption

Hungary contributes to the European Centre for Disease Prevention and Control’s (ECDC) European Surveillance of Antimicrobial Use Network (ESAC-Net), reporting annual sales data on antimicrobial consumption in both the in- and outpatient sectors. Furthermore, all hospitals

providing acute care in Hungary are obliged to participate in the ECDC point prevalence survey (PPS) of HAI and antimicrobial use. Surveillance and study data indicate a widespread misuse of antibiotics in Hungary (e.g. disproportionately high use broad-spectrum agents, particularly quinolones, low use of narrow-spectrum antibiotics and high seasonal variation), even though the country is among the lower antibiotic users in the European Union in terms of quantity.

Monitoring of antimicrobial consumption in hospitals and in outpatient care

In inpatient care, hospital ICACs are mandated to monitor antimicrobial consumption at the facility level. Case-based surveillance data on HAI and AMR are also collected in hospitals and laboratories, respectively, and reported at the national level.

In primary care, the National Health Insurance Fund Administration, within its quality indicator framework, regularly monitors antibiotic prescription rates of individual general practitioners (GPs). Each of the GPs is compared to the mean prescription rate of their peers (urban or rural, paediatric or adult/mixed practices within the same county). Low prescription rates improve their quality score, which is the basis of their quality premium.

Antimicrobial stewardship in Kosovo

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Country-specific information

Kosovo, with a population of 1.7 million inhabitants, is located in Southeastern Europe in the Western Balkans region. No health insurance system has been established yet. Life expectancy in Kosovo is 4 years lower than in neighbouring countries and 10 years lower than the European average. Kosovo is faced with a double burden of disease: communicable diseases and the increasing incidence of non-communicable diseases. Health services in Kosovo are provided through a network of health institutions organised on three levels: primary, secondary and tertiary. Services are provided in public and private health institutions. The main challenges regarding

antimicrobial resistance in Kosovo are limited to financial and human resources, and over-the-counter sales of antibiotics. In December 2018, the Minister of Health signed a new action plan for antimicrobial resistance (AMR) for a period of 3 years. The cornerstone of this action plan will be antimicrobial stewardship (AMS). Other action areas will be strengthening the “One Health” approach, improving the surveillance of antimicrobial resistance and antimicrobial consumption in humans, animals and the environment; prudent use of antimicrobials in clinical practice and the veterinary sector; infection prevention and control in health care settings and the community; and promotion of research and international cooperation.

Antimicrobial stewardship programme

A team of local experts on resistance (TOR), with consultation and support from the experts of Nancy Hospital in France, prepared the terms of reference for AMS in February 2020. The TOR described the responsibilities and competencies of prescribers, nurses, patients, facility managers, AMS team, farmers and stakeholders at both the facility and the national levels. However, due to the COVID-19 pandemic, the implementation of this programme by health institutions has been postponed. Key objectives of AMS are coordination, accountability and leadership, prioritisation of effective interventions for different levels of health care facilities, education and training. In September 2019, Kosovo adopted a new Essential Medicine List, with enrolment of WHO antibiotic classification AWaRe (Access Watch and Reserve), which supports stewardship initiatives. In 2019, 69% of antibiotics prescribed in Kosovo belonged to the WHO AWaRe group. In the field of accountability, the leader of the AMS programme is the chairman of the antimicrobial resistance intersectoral group at the Ministry of Health, while the two co-leaders are a pharmacologist at the University hospital and the President of the Kosovo Chamber of Pharmacists. Information on antibiotic use and resistance is regularly reported to prescribers, pharmacists, nurses, hospital leadership and key stakeholders at the Ministry of Health and the Agency for Food and Veterinary Affairs. There is ongoing training on antimicrobial resistance for prescribers, pharmacists and nurses at all levels of health care, which is supported by the Ministry of Health and various donors (e. g. the Italian Agency for International Development, the Swiss Agency for Cooperation).

Data on antimicrobial consumption

Antimicrobial consumption data in Kosovo are collected in close collaboration with the Kosovo Medicines Agency. The total antimicrobial use data of Kosovo, analysed according to the WHO Anatomical Therapeutic Chemical (ATC)/Defined Daily Doses (DDD) methodology and expressed in DDD/1,000 inhabitants/day (DID) and total (outpatients and hospital care) antibacterial use

amounted to 26.3 DID. Kosovo ranked tenth in antibiotic consumption among European countries. The predominant groups were penicillins, ATC group J01C (12.8 DID, 48.7% of all antibacterials) and other beta-lactam antibacterials, ATC group J01D (4.9 DID, 18.7%). Seasonal variation of quinolone use (i. e. peak in the winter season) was not observed. Low use of systemic antimycotics and antifungals (J02 and D01B) was observed in Kosovo (0.08 DID). This can be explained by the population structure; Kosovo has the youngest population structure in Europe, with only 8.5% of inhabitants above the age of 65. Among consumption of the ten most consumed parenteral agents in 2014, just two drugs (ceftriaxone and gentamicin) accounted for over 81% of total consumption. The latest WHO publication on antibiotic consumption in 45 countries of Europe, published in December 2018, showed that Kosovo had experienced a significant decrease in antibiotic consumption of almost 25%. (from 26.3 DID to 20.1 DID). The main factors influencing this decline in consumption are the increased awareness of the population and health care workers about AMR, media pressure and government commitment to addressing AMR.

Antimicrobial consumption in hospitals and outpatient settings

Data on antimicrobial use were collected in seven hospitals in Kosovo for three consecutive years (2014, 2015 and 2016) using the methodology of a point prevalence survey (PPS) study developed by the European Surveillance Antimicrobial Consumption (ESAC) project and ECDC. Overall antibiotic prescription prevalence rates reached 45% for adult patients and 58.3% for children in the first survey. Among adult patients, this percentage decreased to 39% and 38.4%, respectively, in the last two surveys. However, no significant decrease (56.8% and 58.3%) was observed in children. During the latest survey in the field of antimicrobial consumption in all Kosovan hospitals during 2016, of the 915 patients included in the survey, 520 (56.8%) were using at least one antibiotic on the day of survey. Ceftriaxone was the most prescribed antibiotic (40.3%), followed by oral metronidazole (11.9%) and gentamicin (11.6%). Two main indications reported for antibiotic prescription were community-acquired infection (36% of cases) and surgical prophylaxis (32% of cases). Third-generation cephalosporins were the most prescribed antibiotics for empiric treatment (34.6%), surgical prophylaxis (43.1%) and medical prophylaxis (54.1%), followed by aminoglycosides. Antibiotics were administered mainly through the parenteral route (93.8%). Empiric treatment was the physicians' main choice for prescriptions (87.1%). The main reasons for treatment with an antibiotic were pneumonia (19.8%) and bronchitis (15.8%). The most common indicators for treatment among adults were respiratory tract infection in 23.4% of patients, followed by antibiotic surgical prophylaxis in gynaecology and obstetrics (17.6%). In 12.1% of cases, antibiotics were prescribed to patients with an undefined

site of infection and with no systemic inflammation. Surveillance of antibiotic consumption was also conducted at the primary care level. This survey was a retrospective study involving 12 Family Medicine Centres (FMCs) in six municipal regions of Kosovo. The FMCs were selected using randomisation. This surveillance study showed that 33% of patients had received a prescription for antimicrobial agents. The percentage of administration of antibiotics via parenteral route was 43%. Antibiotic therapy prescription of generic agents accounted for 31% of prescriptions. The most frequently prescribed antibiotic was ceftriaxone, which is usually reserved for use in inpatients only. Precautionary prescription of antibiotics was the justification of some primary care physicians, due to the lack of access to any microbiological laboratory services. Regulatory policies in Kosovo are insufficiently implemented. Although the Administrative Instruction for the Distribution of Antibiotics and Psychotropic Drugs in Kosovo entered into force in 2010, it has yet to be implemented. Drugs are available over the counter and, in many cases, are dispensed by non-qualified persons working in pharmacies. Implementation of the code of conduct for the pharmaceutical industry is necessary to avoid the industry's pressure on prescribers during promotional activities.

Antimicrobial stewardship in Latvia

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Country-specific information

Latvia is a country in the Baltic region of Northern Europe of approximately 1.9 million inhabitants, divided into 110 unitary municipalities and nine republican cities. The health care system in Latvia is based on the residence principle. In- and outpatient health care institutions are operated by the state, municipalities and privately owned companies. The parliament has a significant role in the development of the national health policy. It approves both the national budget and the budget of the National Health Service (NHS). At the end of 2019, there were 61 hospitals with inpatient beds in Latvia, providing 54 beds per 10,000 population. The NHS is responsible for the sourcing of health care services. Providers contracting with the NHS may be public or private. In primary care, the majority of providers are private, in secondary care half are private, and in tertiary care the majority of providers are public institutions, with ownership at national or regional level. Currently, health care for all residents of Latvia is based on state health insurance;

health care services are funded by the state budget within a reimbursement system and individual co-payments. Private insurance is available but is not mandatory.

Antimicrobial stewardship programme

In 2018, on "Antibiotic Awareness Day", the Centre for Disease Prevention and Control of Latvia—in collaboration with the Ministry of Health (MoH), the Ministry of Agriculture (MoA) and the World Health Organization—held the first ever one-day conference "Together against antimicrobial resistance" to raise awareness and discuss antimicrobial stewardship activities. In August 2019, a National One Health Action Plan on Antimicrobial Resistance was approved by the Cabinet of Ministers to combat the development and spread of antimicrobial resistance by ensuring coordinated actions of the involved institutions and organisations. The measures included in the plan pertain to both public health and animal health; therefore, in drafting the plan, the MoH collaborated with the MoA. The plan covers clearly defined objectives to be achieved, although detailed recommendations for targeted implementation in specific healthcare facilities have not been published yet.

In Latvia, laboratories are required by law to report compiled AMR testing results to the Centre for Disease Prevention and Control of Latvia. Data on AMR are reported yearly to EARS-Net, the international data exchange network. Systemic AMR surveillance in Latvia was introduced in 2006. Since 2017, Latvia has participated in the Global Antimicrobial Resistance Surveillance System (GLASS), coordinated by the WHO.

Data on antimicrobial consumption

Latvia is a part of ESAC-Net, reporting data on the consumption of antibiotics intended for human use. The Latvian Summary Report on antimicrobial consumption presents the yearly consumption of antibiotics in the field of human medicine and is based on prescription data, as provided by wholesalers. The total consumption of antibacterials is published annually on the State Agency of Medicines (SAM's) webpage. When submitting data, wholesalers indicate the recipient of the medicines (e.g. a pharmacy, a wholesaler distributor of medicines, a medical institution, an institution of veterinary medical care, a practising veterinarian, a practising physician); however, this does not allow the identification of particular hospitals as the recipients. According to data reported to ESAC-Net in 2019, consumption of antibacterials for systemic use (ATC group J01) in the community (primary care sector) was 11.83 DDD/1,000 inhabitants per day and in the hospital sector 1.85 DDD/1,000 inhabitants per day. Penicillins (J01C) accounted for the largest portion of both overall consumption and consumption in primary care, 36.5% (5 DDD/1,000 inhabitants per day) and 38.6% (4.6 DDD/1,000 inhabitants per day), respectively. Consumption data are based on wholesale data only.

Monitoring of antimicrobial consumption in hospitals

Antimicrobial stewardship programmes and monitoring of antimicrobial consumption at the hospital level have not been implemented nationwide. In August 2020, the Centre for Disease Prevention and Control conducted a survey to assess AMS activities in different health care facilities. Of the 36 facilities surveyed, 28 responded to the inquiry. The results of the survey revealed that most of the health care facilities have implemented some AMS activities, but only three have multimodal antimicrobial stewardship programmes, including annual analysis of antimicrobial consumption in DDD per 1,000 bed days; their granular data on antibiotic consumption were available for individual wards, based on the ATC group level. These AMS programmes were implemented in close collaboration with microbiologists and clinical pharmacists.

However, in order to implement a nationwide AMS programme, we identified the following challenges:

- 1) There is a distinct lack of an electronic prescription system across most health care facilities.
- 2) Detailed implementation guides with practical recommendations are required.
- 3) Access to human resources, staff required to form a multidisciplinary AMS team, is insufficient.

In 2021, a National One Health Action Plan on Antimicrobial Resistance will be developed for the next period, which should include proper components for the implementation of the AMS programme.

Antimicrobial stewardship in Montenegro

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Country-specific information

Montenegro is a Mediterranean country in Southeastern Europe with 625,266 inhabitants and is a parliamentary republic. The unique health region of Montenegro, which has an area of 13,812 km², consists of 23 municipalities grouped into three geographical regions classified by the Statistical Office of Montenegro. Municipalities are characterised by different area size and an unequal population density per km² of territory. In Montenegro, public health services and regulations are under the mandate of the Ministry of Health, which has the mandate to formulate quality standards for hospitals. The principle of mandatory health insurance, combined with the co-insurance of children and non-working partners, covers 99% of the entire population with health insurance. The

health care institutions have been established to ensure the legally established rights of citizens in the field of health care. The network and capacities of health care institutions are planned according to the health needs and characteristics of the population. The network of public health institutions of Montenegro consists of 18 health centres, 8 general hospitals, an Institute for Emergency Medical Aid, an Institute for Blood Transfusion of Montenegro, 3 specialised hospitals, the Clinical Centre of Montenegro, the Institute for Public Health of Montenegro and the Hospital Codra Podgorica, with a total of 2,343 hospital beds.

Antimicrobial stewardship programme

In 2017, the Ministry of Health adopted “The National Strategy for Control of Bacterial Resistance to Antibiotics for the period 2017–2021”, which is a continuation of the National Strategy for Control of Bacterial Resistance to Antibiotics for the period 2012–2016. This is in accordance with the Master Plan for Health Development of Montenegro for the period 2015–2020 and the National Plan for rational consumption of drugs, which resulted from the Master Plan, as well as with the Strategy and Strategic Action Plan of the World Health Organization (WHO) for antibiotic resistance for Europe. The National Strategy for the Control of Bacterial Resistance to Antibiotics determines the goals, action plan and procedures that will be implemented in Montenegro in order to stop the spread of bacterial resistance to antibiotics in human and veterinary medicine. The realisation of the planned activities should achieve the rationalisation of the consumption of antibiotics, and thus control the spread of bacterial resistance to antibiotics. Montenegro is one of a number of European countries with a high consumption of antibiotics and high resistance rates. Recognising the importance of the problem of bacterial resistance to antibiotics, the Ministry of Health of Montenegro, in accordance with its strategy adopted in October 2011, established the National Interdisciplinary Commission for the Control of Antibiotic Resistance (NIKRA), which monitors and coordinates activities in controlling antibiotic resistance. In order to control bacterial resistance to antibiotics, a network for collecting data on bacterial resistance to antibiotics was established in Montenegro on 1 January 2016. The network consists of all microbiological laboratories in the public health sector. Data are collected according to the CAESAR (Central Asian and Eastern European Surveillance of Antimicrobial Resistance) method, a network formed by the World Health Organization (WHO) which also includes Montenegro. So far, the only data on bacterial resistance to antibiotics available are those published in various scientific conferences, which have warned about methicillin-resistant *Staphylococcus aureus* (MRSA) and *E. coli* strains resistant to third-generation cephalosporins. According to these data, 59% of *Staphylococcus aureus* strains isolated from various samples (wound swabs, tubes, intravascular catheters, etc.) in 2010 at the Clinical Centre of Monte-

negro, the largest health institution in Montenegro, were resistant to methicillin. Regarding *E. coli*, 28% of strains isolated from urine in 2006 were resistant to third-generation cephalosporins.

Regarding microbiological diagnostics, the standard procedures described in the guide “Laboratory diagnostics in clinical bacteriology”, which was published on the website of the Ministry of Health, were adopted. Internal quality control in bacterial susceptibility testing on antibiotics was introduced in 2012 by all public health microbiological laboratories of Montenegro. Since 2015, ring trials (external quality control) have been carried out by the WHO. In 2014, the Ministry of Health formed the National Committee for Antibiograms, whose task is to monitor innovations in susceptibility testing of bacteria in microbiology laboratories in Montenegro. Several guidance documents on the rational use of antibiotics in the treatment of bacterial infections have been published on the website of the Ministry of Health, but the application of these guidelines in practice is unsatisfactory. The system for controlling the use of antibiotics in health care institutions is not sufficiently developed. In October 2011, the Ministry of Health established the National Commission for Nosocomial Infections, whose work is complementary to the work of the National Interdisciplinary Commission for the Control of Antibiotic Resistance.

Data on antimicrobial consumption

The Health Insurance Fund and the Agency for Medicines and Medical Devices have a good information system for monitoring the consumption of drugs in hospitals and in the outpatient sector. The Agency for Medicinal Products and Medical Devices collects data on the consumption of all human and veterinary medicines, including antibiotics used in veterinary medicine. The main sources are sales records of wholesalers provided by the Agency for Medicines and Medical Devices. The data are processed in accordance with the recommendations of the World Health Organization and consumption monitoring methodology by the ATC/DDD system. Total consumption of antibacterials for systemic use (ATC class J01) was 27.05 DID (DDD/1,000 inhabitants per day) in 2019 and 26.48 DID in 2018.

Consumption of J01 antibacterials DDD/1,000/inhabitants per day		
Year	Community	Hospital
2018	24.89	1.59
2019	25.38	1.67

Consumption of J01 antibacterials by pharmacological subgroup in community and hospital sector:

Community consumption of J01 antibacterials by pharmacological subgroup DDD/1,000/inhabitants per day		
pharmacological subgroup	2018	2019
Tetracyclines (J01A)	1.27	1.48
Beta-lactams (J01C)	9.89	10.49
Cephalosporins (J01D)	4.43	4.97
Sulphonamides and trimethoprim (J01E)	0.78	1.03
Macrolides, lincosamides and streptogramins (J01F)	4.65	4.92
Aminoglycoside antibacterials (J01G)	0.67	0.63
Quinolone antibacterials (J01M)	3.10	1.83
Other antibacterials (J01X)	0.08	0.04
Hospital consumption of J01 antibacterials by pharmacological subgroup DDD/1,000/inhabitants per day		
pharmacological subgroup	2018	2019
Tetracyclines (J01A)	0.02	0.03
Beta-lactams (J01C)	0.10	0.11
Cephalosporins (J01D)	0.81	0.84
Sulphonamides and trimethoprim (J01E)	0.02	0.02
Macrolides, lincosamides and streptogramins (J01F)	0.13	0.15
Aminoglycoside antibacterials (J01G)	0.21	0.21
Quinolone antibacterials (J01M)	0.15	0.14
Other antibacterials (J01X)	0.14	0.17

Monitoring of antimicrobial consumption in hospitals and in outpatient care

The Ministry of Health of Montenegro coordinates activities in various areas important for the control of bacterial resistance to antibiotics. Other ministries and non-governmental organisations participate in the implementation of this plan. The Ministry of Health has established the National Interdisciplinary Commission for the Control of Antibiotic Resistance (NIKRA). The role of this commission is to advise the Ministry on the need to carry out various activities related to the control of bacterial resistance to antibiotics, to monitor, implement and define the activities and to report to the Minister of Health on the results obtained. In the field of human medicine, the Ministry of Health of Montenegro has established a system of monitoring the resistance of bacteria to antibiotics, which involves all microbiological laboratories. In hospitals in Montenegro with dedicated staff, teams of clinical pharmacologists, infectiologists and clinical microbiologists were formed to decide on the correct antibiotics to use in the process of optimising antibiotic utilisation. Montenegro is taking steps to further educate these teams. Hospitals should strengthen antimicrobial therapy management programmes, including the formation of a list of reserve antibiotics and teams that approve the use of such antibiotics. NIKRA continuously educates doctors of medicine and dentistry, pharmacists and veterinarians on the principles of rational antimicrobial therapy, as well as educating patients about the impor-

tance of proper antibiotic use. In order to improve education in this field, professional and scientific gatherings of health workers dealing with these issues are organised in cooperation with WHO experts.

Antimicrobial stewardship in the Republic of North Macedonia

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Country-specific information

The Republic of North Macedonia is a West Balkan country with approximately 2 million inhabitants. The health care system incorporates both public and private providers. Primary care was privatised and integrated into a Health Insurance Fund and includes 1,445 general practitioners (in 2019). There are 77 hospitals at secondary or tertiary level (general hospitals, clinics, university clinics, specialised hospitals; public and private operators), with a total of 8,754 hospital beds, 2,227 doctors (1,653 specialists) and 5,549 other medical staff (in 2018).

Antimicrobial stewardship programme

A Multisectorial Commission for the Surveillance of Antimicrobial Resistance (MCAMR) under the auspices of the Ministry of Health established national strategies (for the periods 2012–2016, 2016–2020 and 2021–2023) following European guidance and activities (ECDC strategic multi-annual programme) as well as those of the WHO and OIE (Global Action Plan on antimicrobial resistance). Among several specific objectives, such as strengthening the systems for surveillance and control of AMR and nosocomial infections, optimising the use of antibiotics in human and veterinary praxis is a key point. Activities in continuous education are provided throughout the year and especially during the week around “Antibiotic Awareness Day”, conferences as well as supportive supervision on prescribing practices are focused on the general population, doctors in primary healthcare, hospitals, pharmacists, veterinarians, microbiologists and all health care workers.

Data on antimicrobial consumption—primary health care

Surveillance of antibiotic consumption in primary healthcare was established by the Health Insurance Fund and is based on prescription data monitoring. Some antibiotics registered by the Macedonian Agency for Drugs and Medical Devices are not reimbursed by the Health Insurance Fund and are available over the counter, so their consumption can be monitored only by sales data. Total antibiotic consumption in 2018 was similar to that of other low-income EU countries and was around 30 to 35 DDD/1,000 inhabitants per day and around 17 DDD/1,000 insured persons per day. Compared to the respective European average of 20.1 DDD/1,000 inhabitants per day, this clearly supports the need for serious action in the fight against AMR and for rational use of antibiotics.

Monitoring of antimicrobial consumption in hospitals

The consumption of antibiotics in hospitals can be monitored on the basis of local hospital pharmacy data. Several studies were carried out in various hospitals. The study *Consumption of antibiotics and evaluation of bacterial resistance in hospitalised children* was carried out in the University Clinic for Children’s Diseases in Skopje (tertiary healthcare, 177 hospital beds) during 2018. Total antibiotic consumption (ATC code J01) was 30.03 DDD/1,000 bed days (BD). The most widely used antibiotics were cephalosporins (16.36 DDD/1,000 BD), predominantly parenteral third generation cephalosporins (14.76 DDD/1,000 BD; ceftriaxone: 11.46 DDD/1,000 BD), followed by aminoglycosides (3.58 DDD/1,000 BD; amikacin: 3.39 DDD/1,000 BD) and carbapenems (3.45 DDD/1,000 BD; meropenem: 2.65 DDD/1,000 BD).

In the study ‘Assessment of practices for prescribing antimicrobials in hospitals in Skopje, according to the methodology of the “Global Point Prevalence Survey”’ carried out in 12 selected university clinics/institutes and 44 wards (total capacity: 1005 beds) during April–August 2015, antimicrobial hospital stewardship programmes were analysed. The prevalence of prescription, variation in prescribing indications (CAQI, HCAI, surgical prophylaxis and medical prophylaxis), evaluation of prescribing for isolated bacteria and target indicators for quality improvement were analysed. Out of a total of 634 patients, 64.2% received at least one antimicrobial drug. Higher antimicrobial consumption was noted in intensive care units versus internal medicine and surgical wards (89.6%, 74.9% and 55.5%, respectively) as well as in paediatric versus adult wards (71.33% and 61.96%, respectively). Out of 527 prescriptions, third-generation cephalosporins (especially ceftriaxone) were predominant (47.4% and 41.7%, respectively) and any other group administered accounted for 7.9% or less. Most prescriptions were for the treatment of community-acquired infections, followed by surgical prophylaxis (given mainly for more than one day), medical prophylaxis and treatment

of HCAI (39.66%, 36.81%, 12.9% and 10.25%, respectively). Only 14.8% of the antimicrobials were administered for microbiologically confirmed bacterial infections. In general, a low rate (0–37%) of quality indicators' performance was detected.

Antimicrobial stewardship in Poland

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Country-specific information

Poland is a republic of 38.5 million inhabitants, consisting of 16 voivodeships (provinces) with the capital in Warsaw. The country has a statutory health insurance system. There are approximately 950 publicly financed hospitals with 181,732 beds (4.72 hospital beds per 1,000 inhabitants). The system of statutory health insurance, combined with the co-insurance of children and non-working partners, ensures that 99% of the entire population is covered by health insurance.

Antimicrobial stewardship programme

The system of antimicrobial resistance monitoring in Poland was implemented in 1997, when the National Reference Centre for Antimicrobial Susceptibility Testing was established. This institution is responsible for collecting data connected to the consumption of antimicrobial agents in hospitals, identifying alarming pathogens and monitoring the spread of resistant strains. Poland cooperates closely with the European Antimicrobial Resistance Surveillance Network (EARSS-Net) in the area of drug resistance and the European Surveillance of Antimicrobial Consumption Network (ESAC-Net) in the area of the consumption of antibiotics.

Control of hospital-associated infections (HAIs) relies on the responsibility of the Ministry of Health and the State Sanitary Inspectorate. The system is based on sanitary epidemiological stations located in the voivodeships. The Minister of Health nominates a State Consultant for Microbiology who, together with voivodeship consultants for microbiology, is responsible for all policies in accordance with AMR in Poland.

The framework legislation “on the prevention and control of infections and infectious diseases” (Journal of Laws of 2008, item 1570) for hospitals is defined by the so-called Act of 5 December 2008. Together with a list provided by the Ministry of Health “on records of nosocomial infections and alarm agents” and reports on the current epidemiological situation of hospitals (Journal of

Laws of 2011, item 1741), they act as major legal framework for HAIs in Poland. The list specifies all the infectious agents that must be reported and also defines the procedures for the recording of HAIs. It additionally provides a clear statement that the internal control of activities must be carried out by each hospital while external control is performed by competent authorities.

These legal acts state that hospitals are responsible for antimicrobial surveillance and for that reason must have an infection control team. Such teams must include a doctor, infection control and prevention nurses and a microbiologist. The team reports to the State Sanitary Inspectorate on the occurrence of certain strains every year. A State Sanitary Inspector is nominated by the Minister of Health and acts as the head of the State Sanitary Inspectorate. This inspectorate collects data at the national level on case/strain characteristics, patient, hospital, etc.

In 2004, the Ministry of Health established the National Programme for the Protection of Antibiotics (NPOA), which is coordinated by the National Institute of Medicines. In 2016, an updated version of this document was published. The main aim of this programme is to monitor antimicrobial resistance in Poland and to implement strategies for appropriate use of antibiotics in hospitals that foster reduction in the emergence and spread of antimicrobial-resistant pathogens.

Once a year, the “Antibiotic Awareness Day” is organised under the patronage of the Ministry of Health. Poland has taken part in this initiative since 2008.

Data on antimicrobial consumption

The monitoring of antimicrobial consumption remains underdeveloped in Poland. Poland takes part in the European Centre for Disease Prevention and Control's (ECDC) European Surveillance of Antimicrobial Use Network (ESAC-Net). According to these data, the overall consumption density in 2018 was 24.4 DDD/1,000 inhabitants per day, with 23.0 DDD/1,000 inhabitants per day in outpatient care and 1.36 DDD/1,000 inhabitants per day in inpatient care. In comparison to 2009–2017, prescriptions increased by 3.6% (no statistical significance). Penicillins (J01C) had the largest portion of overall consumption as regards outpatients (30.0%), and cephalosporins and other beta-lactams as regards inpatients (32.3%). However, data from European ESAC-Net reports are general, based on total population without any stratification; therefore, the data are of minor benefit to practitioners, doctors or pharmacists.

Monitoring of antimicrobial consumption in hospitals and in outpatient care

Two Orders of the Minister of Health (Minister of Health, 2010a and 2011) and the 2008 Law on the Prevention and Control of Infections and Infectious Diseases impose a number of obligations on health care providers in the area of monitoring and prevention of drug resistance, but without monitoring the use of antibiotics. For

example, there is no obligation on health care providers to undertake actions aimed at improving surveillance of infections, especially infections in hospitals or LTC facilities, such as proving the effectiveness of antibiotic therapy or allocating part of the overall hospital budget to microbiological examinations of clinical materials or antibiotics. There is also no obligation to carry out antimicrobial stewardship activities, for example targeted antibiotic treatment in hospitals, LTC or primary care facilities, even in areas such as neonatal, burn and geriatric care.

In fact, there is no formally accepted definition of antimicrobial stewardship in Poland and such activities are typically associated with rational antibiotic therapy, which depends on subjective opinions and decisions of health professionals; standardisation is generally not well established. For example, there are no formally accepted rules on prescribing antibiotics. In hospitals, adherence to the formulary depends on the organisational culture, while prescribing antibiotics in ambulatory care depends on physicians' experience and drug prices. Simple tests, such as bedside tests for influenza or *Streptococcus pyogenes*, which could be used by paediatricians, or urine dipstick tests, which could be used by geriatricians, are not widely available.

The existing surveillance system concerns only antimicrobial resistance and does not allow information to be fed back to the hospitals. Overall, there is no country-wide and uniform reporting model in place for antimicrobial resistance, antibiotic consumption and outcomes such as *C. difficile* infection which could be considered as both compliant with current international standards as well as accepted by policymakers and hospitals.

Perspectives of AMR stewardship

Professional training for health workers is performed differently for different professional groups, pre- and postgraduate training of physicians and nurses; education standards for the undergraduate level set out that at the end of their undergraduate training, medical students, pharmacists and nurses should be familiar with the problem of antimicrobial use, antimicrobial resistance and adverse reactions from antibiotics—but without antimicrobial stewardship. There is no specific Continuous Medical Education (CME) programme for doctors for training in antimicrobial resistance or antimicrobial use. Postgraduate studies on antimicrobial stewardship at the Jagiellonian University Medical School in Krakow are the sole education programme for prescribers, pharmacists and nurses in Poland.

Antimicrobial stewardship in Romania

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Country-specific information

Romania, located in Southeastern Europe, is the eighth largest country in the EU by area (238,397 km²) and the seventh largest by population (19.41 million; 2019). The Romanian health system is organised on two levels: the national, responsible for the development and implementation of the government health policies, and the local, responsible for regional and district tasks. The National Institute of Public Health (NIPH) provides technical assistance on public health aspects to the national and regional levels. The National Centre for Communicable Diseases Surveillance and Control of the NIPH coordinates Romania's communicable diseases network and is the competent body in liaison with the European Centre for Disease Prevention and Control (ECDC).

The Ministry of Health is represented at district level by 42 public health authorities. Their main tasks are carrying out the public health functions of the Ministry of Health, as well as controlling and evaluating health care provision and the functioning of health care providers.

Most of the 433 public hospitals are managed by local councils, the rest by the Ministry of Health (64) or other central institutions (36). There are 119,000 beds for acute, chronic and palliative care and an additional 7,000 beds are provided by 200 private hospitals.

The National Health Insurance House (NHIH) is an autonomous public institution that administrates the social health insurance system. The basic principle is mandatory health care insurance for employees and co-insurance for non-working companions, combined with state insurance for children and pensioners. This system provides 85% of health insurance cover. The National Health Quality Management Authority is a public institution under the Government's authority, responsible for ensuring the quality of health services and patient safety through accrediting, standardising and evaluating health services.

Antimicrobial stewardship programme

Delays in establishing the Strategic Framework and National Action Plan (NAP) on Antimicrobial Resistance (AMR) placed Romania in a less favourable position in the EU as regards the control of AMR. Late in 2018, a National Intersectoral Committee (NIC) was established to

fight AMR. Romania still lacks robust data on AMR rates, health care-associated infections (HAI) and on antimicrobial consumption. Antibiotic treatment guidelines and educational programmes for prudent antibiotic use are in a basic state.

Data on antimicrobial consumption

Romania has one of the highest consumption rates of antibiotics in Europe. According to the last ESAC report (2018), consumption of antibacterials for systemic use (ATC group J01) was 25.00 DDD, placing the country second in the EU/EEA. Of the total consumption were beta-lactams (J01C) accounted for 44.4% and other beta-lactams 20.6% (J01D; 11.3 and 5.15 DDD/1,000 inhabitants per day), the third highest consumption rate in the EU/EEA. Quinolones represented 13.2% of the total consumption (3.3 DDD/1,000 inhabitants per day), thus first place in the EU/EEA. Data on total consumption in Romania do not differentiate between the community and hospital sectors. For both the community and the hospital sectors, consumption data were based on a combination of sales and reimbursement data provided by private operators (IQVIA and NHIH). Adjustments were made by NIPH using data on antibiotic consumption reported by hospitals. Control of the promotion of antibiotics is exercised by the National Drug Agency, which bans advertising to the general public; interactions between health professionals and sales representatives of the pharma industry are common. Transparency regarding the financial support given by the pharma industry to health professionals has improved significantly during the past 4 years.

Monitoring of AMR and antimicrobial consumption in hospitals and in outpatient care

The project “Strengthening the capacity to address antimicrobial resistance and health care-associated infections in Romania” was launched in March 2020 and is coordinated by the National Institute of Infectious Diseases and NIPH in partnership with the Norwegian Institute of Public Health. Its objectives include improvement of diagnosis of infectious diseases, surveillance of antibiotic resistance, antibiotic consumption in hospitals and ambulatory care, and health professional education and training programmes. The end of this project (2021–2022) should place Romania in line with the international requirements on antibiotic use, AMR and HAI control.

Antimicrobial stewardship in Serbia

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Country-specific information

Serbia is a country of seven million inhabitants situated at the crossroads of Central and Southeastern Europe, consisting of five regions divided into a total of 29 districts. Belgrade, the capital city, represents its own district. The health care system is based on universal health coverage from the National Health Insurance Fund. Health care for the population is provided directly through a network of health care institutions: primary (157 centres), secondary and tertiary (65 acute care hospitals, including 2 private and 20 specialised hospitals). There are 5.5 beds per 1,000 inhabitants; 3.5 per 1,000 inhabitants at secondary and 0.85 per 1,000 inhabitants at tertiary health care level of the acute care hospitals. Besides that, there are 25 regional public health institutes and a National Institute of Public Health, which are responsible for preventive medical activities.

Antimicrobial stewardship programme

In 2011, the Ministry of Health ordered every hospital in Serbia to strengthen the role of their infection control commissions. In addition to previously defined duties, these commissions should also have a role in monitoring and reporting the consumption of antibiotics (ABs), forming a list of reserve ABs, and to give professional advice on the rational use of ABs (Official Gazette of the Republic of Serbia, No 101/13). These commissions, which exist in all hospitals, include a hospital epidemiologist, a microbiologist and representatives of various clinical specialties; they are chaired by the hospital director.

Two years later, in a new rule book, the clinical pharmacologist was listed as a mandatory committee member. However, the infection control commission is a large body that rarely meets, so it was proposed to expand the role of the infection control team in hospitals. This is an operational team that is in close daily contact with all clinical departments and holds frequent meetings while working on the front lines of the hospital. Despite positive experiences, such teams have not yet been established in all hospitals. However, many elements of the antimicrobial stewardship programme have already been introduced in Serbian hospitals. Certain antimicrobials are considered restricted and require prior authorisation for

use by all except a select group of clinicians. Clinicians without authority to prescribe the drug in question must contact the designated antimicrobial stewardship officer and obtain approval to order the antimicrobial. In addition, within the active surveillance of nosocomial infections, compliance with hand hygiene is monitored.

A National Programme for the Control of Bacterial Resistance to Antibiotics for 2019–21 (Official Gazette of the Republic of Serbia, No 8/19) defines the trade and consumption of ABs and monitoring of antimicrobial resistance (AMR) in the medical and veterinary sector. The action plan of this programme defines the steps necessary for introducing a stewardship programme in hospitals.

Data on antimicrobial consumption

Although the National Guideline on the Rational Use of Antibiotics was published in late 2018, some hospitals still suffer from an underestimation or misunderstanding of the problems caused by the inadequate use of ABs and their consequences, as well as a lack of any kind of hospital protocol for the proper application and selection of ABs. The level and quality of staff and equipment varies considerably between different hospitals. Total AB consumption in Serbia for systemic use increased gradually from 2010 (21.2 defined daily doses per 1,000 inhabitants) to 2015 (36.5 defined daily doses per 1,000 inhabitants), when a national campaign for the rational use of antibiotics and reduction of AMR was launched. Under this campaign, a series of educational activities were organised for health professionals, doctors of various specialisms and levels of health care, pharmacists and other medical professionals; educational activities for medicine and pharmacy students were also organised. In addition, citizens were motivated by media publications in the national and local printed and electronic media and on websites. All of the above led to a decline in AB consumption rates in 2017 in comparison to 2015 (32.8% reduction for adults and 12% for children). The largest changes in consumption of pharmacological subgroups occurred in beta-lactams (J01C), which decreased from 17.1 DID in 2015 to 12.3 DID and 9.8 DID in 2016 and 2017, respectively. Furthermore, although not a member of the EU, Serbia participated in the ECDC point prevalence survey of HAI and antimicrobial use in 2017.

Monitoring of antimicrobial consumption in hospitals and in outpatient care

In Serbia, all systemic antibiotics are prescription-only medicines and are fully reimbursed by social insurance. Nearly 90% of all antibiotics are prescribed for outpatients in ambulatory care, with infections of the respiratory and urinary tracts being the most common indications. The inappropriate use of ABs in these health care settings, especially for incorrect indications including potential viral infections, has led to high bacterial resistance. Antibiotic consumption in hospitals accounts for about 10% of total antibiotic use. All hospitals have

adopted the WHO list of essential medicines which can only be prescribed by a team of three specialists including a clinical pharmacologist and an infectiologist, and which are included in the hospitals' list of reimbursed drugs. Monitoring of antibiotic consumption in Serbia is performed by the Agency for Medicines and Medical Devices of Serbia, which—pursuant to its legal obligations—collects, analyses and shares data on antibiotics in medicine (sales data). A new, centralised procurement system was implemented in 2014, which led to an appreciable drop in prices of antibiotics and facilitated monitoring of antimicrobial consumption. In addition, the Federal Fund for Health Insurance collects data on antibiotic consumption in medicine at the primary, secondary and tertiary levels in both the public and private sectors.

Antimicrobial stewardship in Slovakia

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Country-specific information

Slovakia is a landlocked country in the middle of Europe with approximately 5.4 million inhabitants and a population density of 111.23 people per square kilometre. The Ministry of Health of the Slovak Republic defines the minimum scope of health care facilities, operates organisations within its competence (e.g. university hospitals, national institutes, etc.) and its main task is to participate in the creation and implementation of a unified state policy in the field of health care.

Health care in Slovakia is organised through a system of compulsory health insurance administered by three health insurance companies, one of which is a state health insurance company.

According to the data of the Health Statistic Yearbook of the Slovak Republic 2018, compiled by the National Health Information Centre, there were 11,830 health care providers operating 12,902 healthcare facilities at the end of 2018. Outpatient healthcare facilities accounted for 76.4% (9,862 facilities), pharmacies for 15.1% (1,953 facilities), hospitals caring for inpatients 1.4% (180 facili-

ties), haematological and blood transfusion facilities for 0.1% (12 facilities) and others 6.9% (895 facilities). Inpatient healthcare facilities reported a total of 31,382 beds (575.8 beds per 100,000 inhabitants). Of these, 77% were beds in general hospitals, 18% in specialised hospitals, 3.9% in treatment centres, and 1.2% in hospices, nursing homes and biomedical research facilities.

Outpatient health care services are provided by private operators and by the state. Inpatient care in terms of hospitals is operated by the state (as a co-owner or owner through its bodies or institutions), by some ministries, by self-governing regions, municipalities, non-profit organisations, private companies and by non-state religious hospitals.

Antimicrobial stewardship programme

Slovakia has for many years had a well-organised system of so-called antibiotic committees at the local level for health care providers and in the self-governing regions. However, their activities differ in different hospitals; in some, they no longer operate at all. Many medical facilities do not have qualified specialists in hospital epidemiology, hygiene, infectiology, clinical pharmacology, etc. Many hospitals do not actually operate clinical microbiology laboratories, and the cooperation of an institutional medical facility with external clinical microbiology is not always optimal (e.g. overviews of AMR at the level of the treatment unit are not available everywhere). Therefore, parts of this system have started to malfunction and control of the occurrence of resistance and consumption of antibiotics in outpatient practice is insufficient at present. The situation regarding antimicrobial resistance (AMR) is monitored by the National Reference Laboratory for Antibiotic Resistance (NRL) at the Public Health Authority of the Slovak Republic and, since 2004, surveillance has been provided by the Slovak National Antimicrobial Resistance Surveillance System available on the internet (SNARS, www.snars.sk). Currently, approximately 70% of data from routine susceptibility testing of all clinically important bacterial and fungal infectious agents are processed in this way. The implementation of the open system database creates conditions for wide availability of data on antibiotic susceptibility for physicians prescribing antibiotics on a daily basis, for the activities of committees managing antibiotic policy at the level of health care facilities at regional and national levels. The NRL provides methodological guidance, monitoring and basic molecular analysis of important AMR mechanisms, consulting activities as well as an external quality control system for susceptibility testing for clinical microbiology laboratories in Slovakia. In 2014, the NRL initiated the publication of National Recommendations of the Ministry of Health for diagnosis and infection control measures to control bacteria with clinically and epidemiologically significant resistance mechanisms (including carbapenemase-producing enterobacteriaceae, CPE). Despite these activities, according to data from the SNARS, Slovakia is one of the countries with the high-

est AMR to gram-negative and gram-positive microbial pathogens in the EU. EARS-Net 2018 data on monitoring the AMR of invasive isolates rank Slovakia among the countries with the highest incidence of *Escherichia coli* and *Klebsiella pneumoniae* resistant to third-generation cephalosporins and combined resistance to fluoroquinolones and aminoglycosides, *Acinetobacter* spp., *Pseudomonas aeruginosa* resistance to several antimicrobial groups, and a high incidence of MRSA and vancomycin-resistant *Enterococcus faecium*. In addition, since 2013, the spread of CPE has been gradually increasing in Slovakia. In 2018, the Government of the Slovak Republic approved the National Plan for the Control of Infectious Diseases (NPKIO), a strategic document prepared on the initiative of the Ministry of Health and the Public Health Institute of the Slovak Republic. Integral to this document is an action plan for fighting AMR. The aim and strategy of the NPKIO Action Plan for Clinical Microbiology laboratories is to optimise the network of microbiological laboratories; the availability of complex, clinically relevant, affordable, and rapid microbiological diagnostics; the implementation of regular surveys of antimicrobial susceptibility of community and hospital microorganisms; and to broaden molecular methods. Among the indicators, there is the number of medical facilities that have integrated microbiology laboratories and directly available counselling and consulting activities for infectious disease specialists and clinical microbiologists. The NPKIO Action Plan for Antimicrobial Resistance contains objectives and strategies aimed at optimising processes and standards for the reduction and surveillance of AMR, diseases and routes of spread, as well as for elaboration and implementation of standard therapeutic procedures for the use of anti-microbial drugs based on national and local epidemiological data. It constitutes a systematic plan for the availability and standard of use of reserve anti-microbial drugs in defined cases. The plan also aims at modernising and updating the existing SNARS database.

This action plan strengthens the work of committees for rational anti-infective treatment and antibiotic policy (RALAP) in hospitals and in the self-governing regions, and defines the indicators for their optimal function. A separate strategy focuses on prescribing selected antimicrobials based on a pharmacokinetic/pharmacodynamic model, monitoring the levels of selected anti-infectives. Other strategies are aimed at educating health professionals in the field of antimicrobial treatment and hospital hygiene, informing the general public, promoting intersectoral cooperation and the creation of portals (health care-associated infections, antimicrobial resistance) and their connection with epidemiological and hospital information systems. Antimicrobial stewardship programmes are implemented at the local level in some individual hospitals that have created drug formularies guiding prescription in treatment and use programme monitoring indicators (for monitoring AMR and its mechanisms, health care-associated infections and adherence to established hygiene principles, antibiotic consumption, etc.). These are mostly hospitals with in-

tegrated clinical microbiology departments/services. The Slovak Society of Clinical Microbiology of the Slovak Medical Association has long drawn attention to the importance of proper cooperation between microbiological and clinical facilities in view of the increasing centralisation of microbiological services. In cooperation with the Ministry of Health, an expert working group prepared standard procedures for microbiological diagnostics. The first document, issued in 2019, the “Standard Procedure for Laboratory Diagnostics in Clinical Microbiology”, focused on the proper collection and transport of biological material. In 2020, the document “Standard Diagnostic and Therapeutic Procedure for the Implementation of Antimicrobial Policy in Institutional Health Care Facilities” was approved. This standard lists the steps and conditions of an action plan for the implementation of antimicrobial policy. It sets out the necessary activities at national and local levels. The purpose of the standard is to define the composition, scope of work and responsibilities of committees, define the tools of antimicrobial policy, set out the commitment of hospital management and provide a scheme of action plan for the implementation of antimicrobial policy/stewardship. The standard assumes the creation of a network of clinical microbiology laboratories in institutional health facilities with local, regional and national accessibility under the guidance of physicians specialising in clinical microbiology, who will actively participate in the implementation of antimicrobial stewardship in hospitals as members of the RALAP committees.

Data on antimicrobial consumption

According to data in the Health Statistics Yearbook of the Slovak Republic 2018, consumption of dispensed prescription medicines of ATC medicine group J anti-infectives for systemic use (covered by public health insurance) expressed as quantity of dispensed products was 5,873,268 (quantity of medicine in packets) and consumption of medicines sold without prescription to citizens (over-the-counter medicines) of ATC medicine group J anti-infectives for systemic use was 69,187 (quantity of medicine in packs). ECDC data on antibacterial consumption by country showed that consumption of antibacterials for systemic use (ATC group J01) in the Slovak community amounted to 20.21 and to 1.81 in the hospital sector, expressed in DDD per 1,000 inhabitants and per day in 2018. In the community, so-called other beta-lactam antibacterials (J01D) registered the highest consumption (6.21), followed by beta-lactam antibacterials, penicillins (J01C; 5.04), macrolides, lincosamides and streptogramins (J01F; 4.72) and quinolones (J01M; 2.08). In the hospital sector, the highest consumption was registered for other J01 substances (0.54), followed by so-called other beta-lactam antibacterials (J01D; 0.50); the third group was beta-lactam penicillins (J01C; 0.31) and the fourth group was quinolones (J01M; 0.27; all expressed in DDD/1,000 inhabitants per day).

Monitoring of antimicrobial consumption in hospitals and in outpatient care

Consumption of antibiotics in Slovakia in outpatient practice is slightly higher than in other EU countries. In hospitals, antibiotics are mostly prescribed on the basis of microbiological tests and susceptibility results. Slovakia is a country with a disproportionately long administration of antimicrobials in prophylactic administration during surgery and with significantly higher AMR, especially in institutional health care facilities (NPKIO).

Current and future perspectives

In a situation of increasing centralisation of microbiological laboratory services, it is difficult to maintain an individualised concept of clinical microbiology and to regularly provide data and reports on AMR to regional (outpatient) providers and to local treatment units in hospitals.

On the other hand, in a situation of growing AMR, the role of the clinical microbiologist and microbiology laboratories operating at the local/regional level needs to be strengthened through appropriate information technology for data collection and for reporting for antimicrobial surveillance purposes. It is necessary to boost managerial commitment in creating structures for antimicrobial stewardship in accordance with the existing documents (NPKIO, Standard Diagnostic and Therapeutic Procedure for the Implementation of Proper Antimicrobial Policies in Institutional Health Care Facilities).

Antimicrobial stewardship in Slovenia

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Country-specific information

Slovenia is a Central European country with Mediterranean and Balkan influences and an ex-socialist history. According to the 2019 census, Slovenia has 2.1 million inhabitants. The health care system is a combination of the Beveridge and Bismarck models with one central health care insurance institution. Over 99% of the population has compulsory health insurance. In 2017, social security contributions accounted for 66.1% of costs, transfers from state and municipal budget funds for 5.7%; co-payments from voluntary health insurance and out-of-pocket payments cover the rest. Primary care is organised by the municipalities, and most hospitals are operated centrally by the government. Most (26 out of 29) hospitals are

state owned and primary care is a combination of state-owned institutions and private offices included in a public network. A prescription is needed for the purchase of antibiotics, and antibiotics are only prescribed by physicians.

Antimicrobial stewardship programme

A national intersectoral coordinating mechanism (ICM) for prudent use of antimicrobials was established in 2005. In 2011, rules on mandatory surveillance of antimicrobial use in hospitals, antimicrobial stewardship teams and programmes, education of team members and auditing were adopted by the Ministry of Health. A national One Health strategy on the containment of antimicrobial resistance was adopted by the Slovenian government in 2019. The main goals of this strategy are to lower antimicrobial use, to improve its quality, to increase awareness and understanding among the general public and professionals, to decrease infections involving resistant bacteria, to contribute to the control of antimicrobial resistance globally, and to encourage the development of new technologies and innovations for the control of antimicrobial use and resistance. Various educational activities on antimicrobial use and stewardship are available through continuous post-graduate education programmes. Most of the education is organised by the Slovenian Society for Antimicrobial Chemotherapy, but also by other professional societies. In outpatient antibiotic use, various restrictions on the prescribing of fluoroquinolones, co-amoxiclav, third-generation oral cephalosporins, and of macrolides were implemented in the years 2000, 2005 and 2009. In a recent nationwide survey of AMS programmes in hospitals, which included 25 out of 29 hospitals, a formal AMS programme was implemented in more than half of them. However, only one third of them provided salary support for the members of the AMS teams (0.8 FTE per 500 beds), and in only one third did the programme leaders receive special training. All hospitals monitored the quantity of antibiotic use, but written policies for documenting an indication for antimicrobial treatment were present in only 33% of these hospitals. In total, 63% of the participating hospitals had local guidelines. Pre-authorisation of antimicrobials with restricted prescribing regimens was the most frequently used form of AMS intervention.

Data on antimicrobial consumption

In 2019, total consumption of antibacterials for systemic use (ATC/DDD classification, WHO version 2019; J01) was 11.49 DID and 470 RxIDs. Compared with 2018, the prescriptions of antibiotics decreased by 1.4% and 2.3%, respectively. Co-amoxiclav (J01CR) accounted for the largest portion of overall consumption with 24.9% (2.86 DID), followed by extended-spectrum penicillins (J01CA; 19.4%, 2.23 DID), macrolides (J01FA; 13.1%, 1.51 DID), beta-lactamase-sensitive penicillins (J01CE; 12.4%, 1.42 DID) and fluoroquinolones (J01MA; 8.6%,

0.99 DID). Seventy-five percent of all prescriptions were prescribed by family physicians, general practitioners, physicians without specialisation (physicians in training) and paediatricians.

Slovenia has been monitoring the total consumption of antimicrobials for systemic use in all (29) hospitals since 2004. Since 2006, detailed consumption data have been compiled for five special departments (surgery, internal medicine, paediatrics, gynaecology and intensive care). In 2019, the total consumption of J01 for all hospitals amounted to 1.50 DID and to 49.06 DDD/100 bed-days and 295.79 DDD/100 admissions. Penicillins with beta-lactamase inhibitors (J01CR) were prescribed most commonly (26.7%, 0.40 DID), followed by fluoroquinolones (J01MA; 11.3%, 0.17 DID), antistaphylococcal penicillins (J01CF; 10.7%, 0.16 DID) and macrolides (J01FA; 6.7%, 0.10 DID).

Monitoring of antimicrobial consumption in hospitals and in outpatient care

Slovenia has been monitoring outpatient antibiotic consumption since 1976. Hospital antibiotic use has been measured periodically every 5 years since 1985. In 2001, Slovenia joined the ESAC projects. The present national system for the surveillance of antimicrobial use was developed on the basis of ESAC criteria. In 2010, the country joined the European Surveillance of Veterinary Antimicrobial Consumption (ESVAC) system. Antimicrobial consumption surveillance is mandatory for hospitals. Audits on antimicrobial use in hospitals are performed by members of the ICM every few years. The audits include review of patients' records and of AMS programmes. Several Slovenian hospitals regularly participate in various international point prevalence surveys of antimicrobial use. Slovenia participated partially in the two ECDC-led surveys on antimicrobial use in long-term care facilities and performed a nationwide LTCF survey in 2016. Outpatient antibiotic use is also monitored by the national insurance institution.

Antimicrobial stewardship in Turkey

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Country-specific information

Turkey currently spends 4.4% of its gross domestic product (GDP) on health, the lowest rate amongst OECD (Organisation for Economic Co-operation and Development) countries. This percentage is one percentage point

lower than Luxembourg (5.4%) and less than one third that of the United States of America (17.0%).

AMR stewardship programmes

The Turkish Ministry of Health established the National Hospital Antimicrobial Restriction Programme (NHARP) and the National Antimicrobial Resistance Surveillance System (NAMRSS) for AMR stewardship. NAMRSS was established in 2011 and became a part of the WHO's Central Asian and Eastern European Surveillance of Antimicrobial Resistance (WHO-CAESAR) system. NAMRSS aims to identify AMR incidences and to provide reliable annual data as a scientific base for developing new policies. NHARP, which aims to reduce overconsumption of antibiotics in hospitals, was established in 2003. The prohibition of over-the-counter sales of antibiotics in 2017 constituted a milestone in Turkey's AMR stewardship efforts.

Current AMR statistics

Antibiotic consumption in Turkey (38.2 DID—daily doses of antibiotic for 1,000 people/day) is nearly double the average (17.9 DID) of other European region countries. Turkey has a high incidence of antibiotic-resistant bacterial pathogens (42%), second only to Greece (45%). In gram-negative pathogens, 37% of the *K. pneumonia* are carbapenem resistant, while the EU average is 7.5%. Among gram-positive pathogens, 26% of *S. aureus* isolates are methicillin-resistant, i. e. MRSA, while the EU mean is 16.4%. Of *Acinetobacter* spp., 92% are carbapenem resistant; this is approximately three times greater than the mean rate for Europe.

Perspectives of AMR stewardship

Antimicrobial stewardship programmes (ASPs) in Turkey still need to be improved. The development of ASPs should include monitoring of outpatient antimicrobial use and aim at educational programmes that address proper prescription of antimicrobials according to regional resistance situations. Outpatient antibiotic use should be monitored as a matter of urgency, as antibiotics account for nearly 25% of prescriptions written by Turkish general practitioners/family physicians. To date, Turkey has no official programme for—nor consumption data on—agricultural use of antimicrobials. Monitoring of antimicrobial use in the livestock industry nationwide is just as important as infection control. ASPs in Turkey should be upgraded by launching additional programmes and improving existing ones.

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