Surveillance of antimicrobial resistance in Europe, 2020 data

Executive summary

WHO European Region

The results presented in this executive summary are based on antimicrobial resistance (AMR) data from invasive isolates reported to the Central Asian and European Surveillance of Antimicrobial Resistance (CAESAR) and the European Antimicrobial Resistance Surveillance Network (EARS-Net) in 2021 (data referring to 2020). Twelve countries and Kosovo[1] reported data to CAESAR, while 29 countries, including all from the European Union (EU) and two from the European Economic Area (EEA) (Iceland and Norway), reported data to EARS-Net.

While the EARS-Net and CAESAR networks use comparable methods for data collection and analysis, the results presented in this executive summary originate from distinct country/area surveillance systems. As these inherently are influenced by specific protocols and practices, caution is advised when comparing countries/areas in terms of AMR patterns.

Epidemiology

The AMR situation in bacterial species reported to the AMR surveillance networks in 2020 varied widely depending on the bacterial species, antimicrobial group and geographical region. Resistance to third-generation cephalosporins and carbapenems generally was higher in *Klebsiella pneumoniae* (*K. pneumoniae*) than *Escherichia coli* (*E. coli*). While carbapenem resistance remained rare in *E. coli* for most countries, 30% of countries reported resistance percentages of 25% or higher in *K. pneumoniae*. Carbapenem resistance was also common in *Pseudomonas aeruginosa* (*P. aeruginosa*) and *Acinetobacter* spp., and at a higher percentage than in *K. pneumoniae*. As has been observed in previous regional reports, there is a north-to-south and west-to-east gradient of resistance, with higher rates observed in the southern and eastern parts of the Region. This was particularly evident for fluoroquinolone resistance in *E. coli*, third-generation cephalosporin and carbapenem resistance in *K. pneumoniae* and carbapenem resistance in *Acinetobacter* spp. Time trend analysis of resistance proportions by country was performed for EU/EEA countries. The results are summarized in the EU/EEA section.

Considering only the countries and areas that submitted data to CAESAR both in 2019 and 2020, the overall number of isolates reported was lower in 2020 than in 2019. This was a result of lower numbers of *E. coli*, *P. aeruginosa*, *Staphylococcus aureus* (*S. aureus*) and *Streptococcus pneumoniae* (*S. pneumoniae*) isolates being reported. Higher numbers were reported for *Acinetobacter* spp. and *Enterococcus faecium* (*E. faecium*). These overall tendencies were not always observed at country level, however all but one country reported higher numbers of

1 All references to Kosovo in this document should be understood to be in the context of the United Nations Security Council resolution 1244 (1999).

Acinetobacter spp. isolates in 2020 than in 2019. In 2020, *E. coli* (38.4%), *S. aureus* (17.3%) and *K. pneumoniae* (14.9%) represented the majority (70.6%) of isolates.

Looking at bacterial species-specific results in 2020, resistance to fluoroquinolones in *E. coli* was generally lowest in northern and western parts of the WHO European Region and highest in southern and eastern parts. A resistance percentage below 10% was observed in one (3%) of 40 countries reporting data on this microorganism. A resistance percentage of 25% or above was reported in 20 (50%) countries. A resistance percentage of 50% or above was observed in three (8%) countries. For third-generation cephalosporin resistance in *E. coli*, 10 (25%) of 40 countries reported the lowest resistance percentages (5–10%), whereas resistance percentages equal to or above 50% were observed in five (13%) countries. The recent emergence of carbapenem-resistant *E. coli* is of serious concern. Six (15%) of 40 countries reported resistance percentages of 1% or above.

Third-generation cephalosporin resistance in *K. pneumoniae* has become quite widespread in the WHO European Region. In 2020, percentages below 10% were observed in six (15%) of 41 countries reporting data on this microorganism, while 18 (44%) countries, particularly in the southern and eastern parts of the Region, reported resistance percentages of 50% or above. Carbapenem resistance was more frequently reported in *K. pneumoniae* than in *E. coli*. In 2020, resistance percentages generally were low in the northern and western parts of the WHO European Region; 16 (39%) of 41 countries reported resistance percentages below 1%. Twelve (30%) countries reported percentages equal to or above 25%, six of which (15% of 41 countries) reported resistance percentages equal to or above 50%.

Large differences were observed in the percentages of carbapenem-resistant *P. aeruginosa* in the Region. In 2020, resistance percentages of below 5% were observed in four (10%) of 41 countries reporting data on this microorganism, whereas six (15%) countries reported percentages equal to or above 50%.

The percentages of carbapenem-resistant *Acinetobacter* spp. varied widely within the Region in 2020, from below 1% in three (8%) of 38 countries reporting data on this microorganism to equal to or above 50% in 21 (55%) countries, mostly in southern and eastern Europe.

In 2020, nine (23%) of 40 countries reporting data on *S. aureus* had the lowest methicillin-resistant *S. aureus* (MRSA) percentages (below 5%). MRSA percentages equal to or above 25% were found in 10 (25%) of 40 countries.

Large differences were observed across the Region in the percentage of penicillin non-wild type *S. pneumoniae*. Three (9%) of 35 countries reporting data on this microorganism had proportions below 5% in 2020, whereas percentages equal to or above 25% were found in nine (26%) countries.

Resistance to vancomycin in *E. faecium* varied substantially among countries in the Region. In 2020, resistance percentages of below 1% were reported by seven (18%) of 38 countries reporting data on this microorganism, while percentages equal to or above 25% were found in 13 (34%), four of which (11% of 38 countries) reported resistance percentages equal to or above 50%.

Discussion

These results from CAESAR and EARS-Net show clearly that AMR is widespread in the WHO European Region. While assessing the exact magnitude of AMR remains challenging in many settings, the presence of specific AMR patterns across clinical settings covered by the surveillance networks is apparent. High percentages of resistance to third-generation cephalosporins and carbapenems in *K. pneumoniae*, and high percentages of carbapenem-resistant *Acinetobacter* spp. in several countries, are of concern. They suggest the dissemination of resistant clones in health-care settings and indicate the serious limitations in treatment options in many countries for patients with infections caused by these pathogens. While the west-to-east gradient in AMR percentages is evident for gram-negative bacteria (*E. coli*, *K. pneumoniae*, *Acinetobacter* spp.), it is less obvious for gram-positive bacteria (*S. aureus*, *S. pneumoniae*, *E. faecium*). As antimicrobial-resistant bacterial microorganisms cannot be contained within borders or regions, these results underline the need for concerted action to combat AMR throughout the WHO European Region.

The impact of the COVID-19 pandemic on AMR is apparent in many ways. Many countries providing AMR data to CAESAR reported fewer *E. coli* isolates in 2020 than in previous years. This may be related to decreased health-care activities in areas not linked directly to the COVID-19 response, including less engagement in AMR surveillance activities. In addition, many countries and areas in the WHO European Region reported lower numbers of *S. pneumoniae* isolates in 2020 than in previous years, which may be a result of the decreased circulation of respiratory pathogens in the community during lockdowns and the enforcement of measures to control the spread of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). On the other hand, typical health-care-associated pathogens such as *Acinetobacter* spp. and *E. faecium* were more frequently observed during 2020 than in previous years in many countries and areas.

Since the adoption of the European Strategic Action Plan on Antibiotic Resistance in 2011 *(1)* and the publication of the Global Action Plan on Antimicrobial Resistance (GAP-AMR) in 2015 *(2)*, most Member States of the WHO European Region have enhanced efforts to tackle AMR. Only 25 (50%) of the 50 countries reported having developed a national action plan (NAP) on AMR in 2016, but the latest round of global monitoring showed that this had increased to 43 (86%) of the 50 countries who responded in the Region *(3)*. The challenge ahead is how to ensure comprehensive implementation and adequate funding for the NAPs. This shortcoming is more evident when looking at surveillance capacity in the WHO European Region: 20% of countries still reported either having no capacity for generating AMR surveillance data or collecting AMR data only at local level and without a standardized approach.

Similarly, efforts to improve antimicrobial consumption in the Region remain heterogeneous. While 14 (48%) countries reporting to the European Surveillance of Antimicrobial Consumption Network (ESAC-Net) met WHO's suggested national target of 60% of total antibacterial consumption each year being derived from WHO's Access category (as defined in the Access, Watch, Reserve (AWaRe)[2] classification list *(4)*), during the period 2014–2018, only one (7%) country reporting to the WHO Regional Office for Europe Antimicrobial Medicines Consumption Network achieved this target in each of these five years.

Public health implications

AMR is a looming threat to the health of millions of people worldwide. The COVID-19 pandemic has exposed the weaknesses in national health systems and the interconnectedness of countries and continents. Continuity of efforts to tackle AMR has been seriously challenged by repurposing health-care professionals to support the COVID-19 response across the European Region, and the effects of the pandemic on people and public health still need to be fully evaluated. This crisis is a powerful reminder that governments will need more coordinated action and collaboration than ever before to confront future health threats. Despite the global call for action that was renewed with the GAP-AMR in 2015 *(2)*, the EU One Health Action Plan in 2017 *(5)* and the subsequent commitment by Member States to develop NAPs, several countries are only just starting on their roadmap to implement effective interventions to tackle AMR. High-level commitment is still lacking and important programmes and interventions on infection prevention and control (IPC), antimicrobial stewardship and surveillance remain under-resourced. Despite important advances, this executive summary highlights the persistent disparities in AMR prevalence across the WHO European Region and uncovers unexploited opportunities to counteract AMR. Greater efforts and investment are required to increase the comparability, quantity and quality of AMR surveillance data.

EU/EEA countries

The EU and EEA results presented in this executive summary are based on AMR data from invasive isolates reported to EARS-Net by 29 EU/EEA countries in 2021 (data referring to 2020) and on trend analyses of data reported by participating countries for the period 2016–2020. The latest country-specific data can be retrieved from ECDC's Surveillance Atlas of Infectious Diseases *(6)*.

2 AWaRe classifies antibiotics into three stewardship groups – Access, Watch and Reserve – to emphasize the importance of their optimal uses and potential for AMR.

Epidemiology

The overall number of reported isolates at EU/EEA level increased in 2020 compared to 2019 for all bacterial species except *S. pneumoniae*. These increases were not always observed at country level. There was a large decrease in the overall number of *S. pneumoniae* isolates between 2019 and 2020, with similarly large decreases reported in all but one country.

The AMR situation reported by EU/EEA countries to EARS-Net for 2020 varied widely depending on the bacterial species, antimicrobial group and geographical region. Overall for the EU/EEA, most of the bacterial species–antimicrobial combinations showed either a significantly decreasing trend or no significant trend in the population-weighted mean AMR percentage during 2016–2020.[3] The exceptions to this were carbapenem resistance in *E. coli* and *K. pneumoniae* and vancomycin resistance in *E. faecium*, for which there was a significant increase during this period.

In 2020, more than half of the *E. coli* isolates reported to EARS-Net and more than a third of the *K. pneumoniae* isolates were resistant to at least one antimicrobial group under surveillance, and combined resistance to several antimicrobial groups was a frequent occurrence. Among antimicrobial groups monitored for both species, AMR percentages generally were higher in *K. pneumoniae* than in *E. coli*. Carbapenem resistance remained rare in *E. coli*, but almost a quarter of EU/EEA countries reported carbapenem resistance percentages above 10% in *K. pneumoniae*. Carbapenem resistance was also common in *P. aeruginosa* and *Acinetobacter* spp. and at a higher percentage than in *K. pneumoniae*. For most gram-negative bacteria under surveillance, changes in the EU/EEA population-weighted mean AMR percentages between 2016 and 2020[3] were moderate and AMR remained at high levels, as previously reported.

For *S. aureus*, a decrease in the percentage of MRSA isolates was reported during 2016–2020.[3] MRSA nevertheless remains an important pathogen in the EU/EEA, with levels remaining high in several countries and combined resistance to another antimicrobial group common. A decreasing trend was also seen during 2016–2020[3] for the percentage of macrolide resistance in *S. pneumoniae*.

One development of particular concern was the increasing trend in the EU/EEA population-weighted mean percentage of vancomycin-resistant isolates of *E. faecium*, which increased from 11.6% in 2016 to 16.8% in 2020.[3]

The reported AMR percentages for several bacterial species–antimicrobial group combinations varied widely among countries, with a north-to-south and west-to-east gradient evident. In general, the lowest AMR percentages were reported by countries in the north of Europe and the highest by countries in the south and

3 Data from the United Kingdom were excluded.

east. There was no distinct geographical pattern for vancomycin-resistant *E. faecium*.

Discussion

WHO characterized COVID-19 as a new pandemic in March 2020 *(7)*. SARS-CoV-2 presented the world with a new and globally distributed infectious agent that affected public health across the planet, albeit with vaccines developed and recommended for authorization towards the end of 2020 *(8)*. Despite the pandemic, all EU/EEA countries that regularly report AMR data reported 2020 data in 2021.

The COVID-19 pandemic and the related public health interventions may have affected the reporting and analysis of results of 2020 AMR data in different ways and to varying degrees over time. Examples of this could include changes in hospital admission patterns *(9)*, prescription of antimicrobials *(9)*, laboratory reporting capacity, or public health interventions *(9)*. Changes in public health interventions could, for example, explain the decrease in the number of *S. pneumoniae* isolates reported by EU/EEA countries for 2020.

The decreasing AMR trends in the EU/EEA during 2016–2020[3] for several bacterial species–antimicrobial group combinations under surveillance by EARS-Net had in most cases already been noted in the annual epidemiological report for 2019 *(10)*. Significantly increasing trends for carbapenem resistance in *E. coli* and *K. pneumoniae* and vancomycin resistance in *E. faecium* were observed for the period 2016–2020,[3] similar to the previously reported trends for 2015–2019 when the United Kingdom was included *(10)*.

A large decrease in community antibiotic consumption in the EU/EEA was reported by ESAC-Net for 2020 *(11)*. Concomitant large changes in AMR percentages were not observed at EU/EEA level in EARS-Net. For *E. coli*, there was a larger decrease in the percentages of resistance to aminopenicillins and third-generation cephalosporins in the EU/EEA in 2020 than for each year during the period 2016–2019. For a few other bacterial species–antimicrobial group combinations, there were large increases in AMR percentages at EU/EEA level between 2019 and 2020, although an increasing trend during 2016–2020[3] was reported only for carbapenem resistance in *K. pneumoniae*.

Limitations to the quality of AMR data and interpretation of AMR percentages should be taken into consideration. For example, there have been changes in the reporting of data to EARS-Net over time within countries and at EU/EEA level. This could have influenced the results, and this fact should be borne in mind when interpreting trends. The analysis for *P. aeruginosa* and aminoglycosides, for instance, changed: previously, the analysis included netilmicin, gentamicin and tobramycin, but from 2020 onwards it includes only tobramycin. This hampers interpretation of the decrease in aminoglycoside resistance percentages observed for 2020. Other examples are changes to country surveillance systems, which may affect interpretation of AMR percentages over time, and restriction on data generated using European Committee on Antimicrobial Susceptibility Testing (EUCAST) breakpoints and methodology, starting with data collected for 2019. The restriction to EUCAST breakpoints and methodology should, however, improve quality and comparability of data in the long term.

AMR percentages for the bacterial species–antimicrobial group combinations under surveillance continue to be high overall in the EU/EEA and the large variability in AMR percentages across EU/EEA countries remained in 2020. This highlights the opportunities for significant AMR reduction through interventions to improve IPC and antimicrobial stewardship practices.

For health-care settings, results from the ECDC point prevalence survey of health-care-associated infections and antimicrobial use in European acute-care hospitals showed that the prevalence of patients receiving antibiotics was positively associated with AMR and, conversely, higher antibiotic stewardship activities and resources for IPC were associated with lower AMR percentages *(12)*. Another study showed that knowledge and perceived knowledge about antibiotics, antibiotic use and antibiotic resistance was high among health-care workers in EU/EEA countries, while highlighting areas where there was a need for educational interventions *(13)*. Prudent antimicrobial use and high standards of IPC in all health-care sectors remain the cornerstones of an effective response to AMR, and these studies highlight areas for improvement in health-care settings across the EU/EEA.

For the community, a recent study covering the period 2014–2018 reported on statistically significant decreasing trends in the total consumption of antibiotics for some EU/EEA countries *(14)*. The long-term effects on AMR of the large decrease in community antibiotic consumption observed in almost all EU/EEA countries in 2020 *(11)* remain to be seen. The major drivers behind the occurrence and spread of AMR are the use of antimicrobial agents and the transmission of antimicrobial-resistant microorganisms between humans, between animals, and between humans, animals and the environment. Antimicrobial use exerts an ecological pressure on microorganisms and contributes to the emergence and selection of AMR, and poor IPC practices promote further spread of antimicrobial-resistant microorganisms. Prudent use of antimicrobials therefore is advisable, and relevant EU guidelines have been published by the European Commission *(15)*. Moreover, the importance of infection prevention in society as a whole through, for example, appropriate hand hygiene and vaccination should not be overlooked in the work against AMR.

AMR calls for concerted efforts at country level and close international cooperation. In 2017, the European Commission adopted a European One Health Action Plan against AMR to support the EU and its Member States in delivering innovative, effective and sustainable responses to AMR *(5)*. A majority of EU/EEA countries in a 2017 survey reported having implemented or initiated

3 Data from the United Kingdom were excluded.

work towards establishing objectives and targets for the reduction of antibiotic use in humans, often through the development of a NAP on AMR. Only a few, however, had published these targets in 2017 *(16)* and had identified specific funding sources to implement their NAPs *(12)*. As of 2020, 25 out of 29 EU/EEA countries had reported having a NAP on AMR and three others were in the process of developing a NAP.

Public health implications

The high levels of AMR for several important bacterial species–antimicrobial group combinations reported to EARS-Net for 2020 show that AMR remains a serious challenge in the EU/EEA. Indeed, AMR is a considerable threat to public health both in the EU/EEA *(5)* and worldwide *(2)*. Estimates based on data from EARS-Net show that each year, more than 670 000 infections occur in the EU/EEA due to bacteria resistant to antibiotics and that approximately 33 000 people die as a direct consequence of these infections *(17)*. The related cost to the health-care systems of EU/EEA countries is estimated to be around €1.1 billion *(12)*.

Public health action to tackle AMR remains insufficient, despite increased awareness of AMR as a threat to public health and the availability of evidence-based guidance for IPC, antimicrobial stewardship and adequate microbiological capacity. AMR will be an increasing concern unless governments respond more robustly to the threat. Further investment in public health interventions is needed urgently to tackle AMR. This would have a significant positive impact on population health and future health-care expenditure in the EU/EEA. It has been estimated that a mixed intervention package that included antibiotic stewardship programmes, enhanced hygiene, mass media campaigns and the use of rapid diagnostic tests would have the potential to prevent approximately 27 000 deaths each year in the EU/EEA. In addition to saving lives, such a public health package could pay for itself within just one year and save around €1.4 billion per year in the EU/EEA *(12)*.

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4 All weblinks accessed 26 October 2021.

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