MONITORING **ANTIMICROBIAL RESISTANCE** IN THE **EU**

Addressing the challenges and supporting effective action

HAI HEALTH ACTION INTERNATIONAL

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Addressing the challenges and supporting effective action

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BACKGROUND

Antimicrobials, medicines crucial for the treatment of infections caused by bacteria, viruses, fungi and parasites, are becoming less effective due to overuse and misuse, which has led to the rising tide of antimicrobial resistance (AMR). Referred to as 'the silent pandemic', AMR burdens healthcare systems financially and causes over 35,000 deaths annually in the European Union (EU) alone.[1,2] Indeed, it is considered one of the EU's top three health threats.[3]

The EU's efforts to combat AMR have been extensive and multifaceted, reflecting a commitment to public health that spans several decades. Since the recognition of AMR as a critical health issue, the EU has approved a series of strategic interventions, legislative reforms, and collaborative efforts.[4] These include the Community Strategy against Antimicrobial Resistance published in 2001, decisive legislation banning antimicrobials as growth promoters in animal feed, and comprehensive AMR action plans addressing human and animal health, and environmental factors.[5,6]

EU AMR Targets and Recommendations

In recent years, the EU has further solidified its approach to AMR through revisions of its pharmaceutical legislations, including AMR mitigation strategies within these documents.[7] It has also proposed specific AMR targets to be reached by 2030, highlighting its continued efforts to address this critical global health threat.[8] Specifically, in 2023 the EU Council adopted targeted measures to tackle AMR through a comprehensive One Health approach. Based on 2019 benchmarks, the Council aims to achieve the below goals by 2030.[9]

The aim of this booklet is to increase awareness about the importance of monitoring and addressing AMR in the EU, and to support more effective action against AMR. It provides an overview of EU targets for key pathogens, the current AMR status at country- and EU-level, and progress towards targets for managing and containing AMR.

In **Part 1**, we focus on the progress towards achieving the first target: Reducing overall antibiotic use in humans by 20% by 2030. In **Part 2**, the focus is on the second target: Ensuring at least 65% of antibiotics used in humans fall in the Access category. In **Part 3** targets three to five will be covered: Reducing bloodstream infections caused by methicillin-resistant Staphylococcus aureus (MRSA), third-generation cephalosporin-resistant Escherichia coli (E. coli) and carbapenem-resistant Klebsiella pneumoniae (CRKP) by 5% to 15%.

Reduce **overall antibiotic** use in humans by **20%.**	At least **65%** of human-used antibiotics are in the **Access category***.	Decrease **MRSA** bloodstream infections by **15%.**	Cut bloodstream infections from 3rd-gen **cephalosporin -resistant E. coli** by **10%.**	Reduce bloodstream infections from **CRKP** by **5%.**

** The Access category refers to antibiotics that are recommended as first or second-choice treatments for specific infections and are generally more available and affordable. This classification is part of the WHO AWaRe (Access, Watch, and Reserve) antibiotic categorization framework aimed at promoting the appropriate use of antibiotics to combat AMR.[10]*

PART 1

REDUCE OVERALL ANTIBIOTIC USE IN HUMANS BY 20%

An overview of the EU's progress towards achieving an overall reduction in antibiotic use of 20% by 2030

Current Status and Trends

Figure 1 provides an overview of the average consumption of antibiotics in the EU from 2013 to 2022, as well as the target of a 20% reduction in consumption from 2019 to 2030. From 2013 to 2022, average consumption of antibiotics has decreased gradually, from 21.6 defined daily dose (DDD) per 1,000 inhabitants per day in 2013 to 19.4 DDD/1,000 inhabitants/day in 2022. Notably, there was a significant drop to 16.4 DDD/1,000 inhabitants/day in both 2020 and 2021, likely influenced by the COVID-19 pandemic and related health measures. In 2022, the DDD increased again to 19.4; higher than the previous two years but slightly lower than in 2019. A 20% reduction in antibiotic consumption in 2030 compared to 2019 would mean the average use in 2030 would be 15.9 DDD/1,000 inhabitants/day, a target that, considering current trends, seems unlikely to be met.[11]

Figure 1. *EU average antibiotic consumption over time, and the 2030 target.*

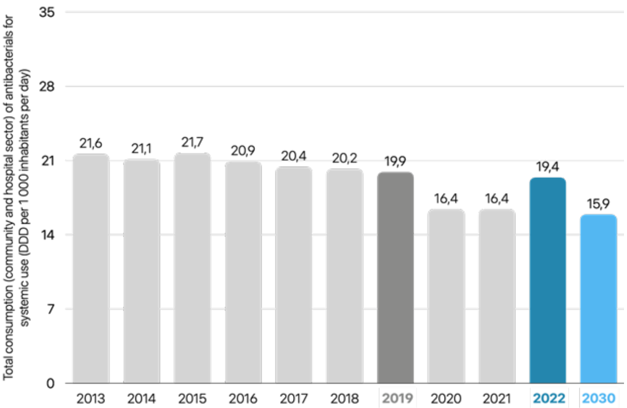
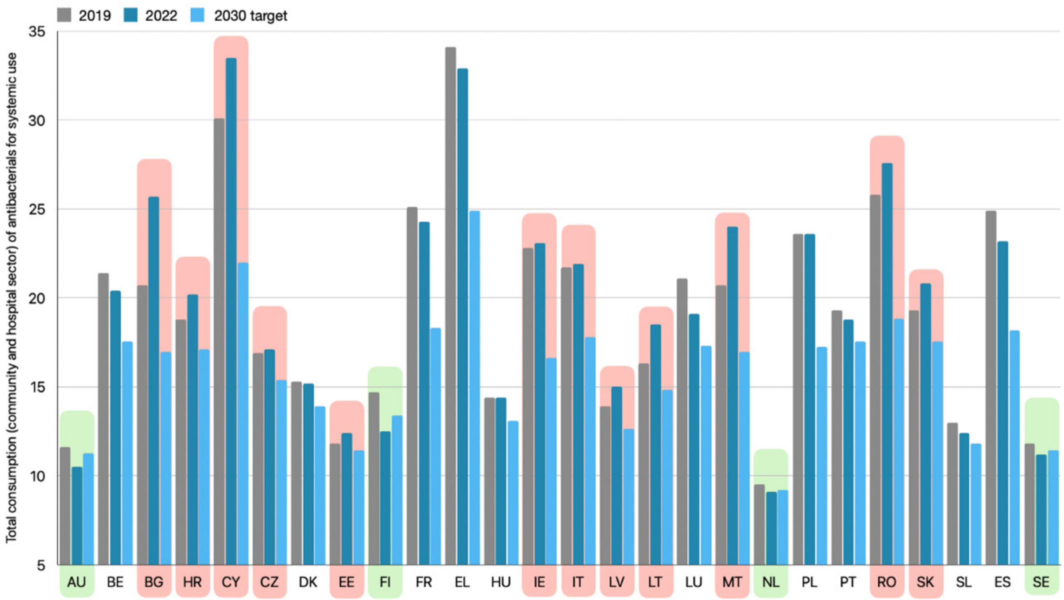


Figure 2 presents an overview of antibiotic consumption across EU/European Economic Area (EEA) countries, highlighting three key data points: 2019 consumption (grey bars), 2022 consumption (dark blue bars), and 2030 20% consumption reduction targets (light blue bars).

Four different reduction targets have been set. For countries with already relatively low consumption levels (less than 12 DDD/1,000 inhabitants/day) in 2019 (Austria, Estonia, the Netherlands and Sweden), the target is a 3% reduction. For countries with consumption levels between 12 and 20 DDD/1,000 inhabitants/ day, the target is a 9% reduction. Countries with consumption levels between 20 and 22 DDD/1,000 inhabitants/day have a reduction target of 18%, and countries with consumption levels of 23 DDD/1,000 inhabitants/day or higher need to reduce their consumption by 27%.[8]

As can be seen in the figure, Austria, Finland, the Netherlands and Sweden already met their 2030 target in 2022 (highlighted in green). On the other hand, in 12 of 26 countries (highlighted in red) – Bulgaria, Croatia, Cyprus, Czechia, Estonia, Ireland, Italy, Latvia, Lithuania, Malta, Romania and Slovakia – consumption levels increased from 2019 to 2022, making it unlikely that the 2030 targets will be met. Further, while slight decreases in consumption can be seen in Belgium, Denmark, France, Greece, Hungary, Poland, Portugal and Spain, more concerted efforts are likely needed to reach their 2030 targets as well.[11]

Figure 2. *Antibiotic consumption in EU Countries: 2019, 2022, and 2030 targets.*



Key Takeaways

Reducing AMR through targeted and measurable goals is a critical step in combating one of the most pressing health threats. The EU's target to reduce antibiotic consumption to 15.9 DDD per 1,000 inhabitants by 2030 is a significant and ambitious goal. The gradual decrease in antibiotic consumption seen from 2013 to 2022, including the notable drop during the COVID-19 pandemic, shows that achieving this target is possible with continued efforts and strategic interventions. In line with this, the progress of several countries in meeting or exceeding their 2030 targets is promising. Austria, Finland, the Netherlands and Sweden have shown significant success, with 2022 antibiotic consumption levels already below 2030 targets. However, among the 26 countries analysed, 20 could be said to either be lagging behind or struggling to meet their 2030 targets. This highlights the need for intensified efforts and customised strategies to address specific challenges countries are facing in reducing antibiotic use.

ACTION

Continuous and sustained monitoring is essential to evaluate countries' performance and contextualise strategies based on current conditions. Using data to create a more dynamic and adaptive approach to target-setting is crucial to ensure as much as possible is done to combat AMR. For countries already meeting their targets, periodic reassessment of goals should be considered. Additionally, using incentives such as funding opportunities for research, public health awareness campaigns, and support for improved healthcare- and workforce infrastructures could help countries achieve 2030 targets. Such measures can help maintain momentum and ensure sustained progress across the EU.

Overall, the EU's AMR strategy is moving in the right direction, but ongoing adaptation and support will be critical to achieve and sustain the desired reductions in antibiotic consumption, thereby mitigating the threat of AMR.

PART 2

AT LEAST 65% OF HUMAN-USED ANTIBIOTICS ARE IN THE ACCESS CATEGORY

Insight into the EU's progress towards achieving the target of at least 65% of antibiotics used in humans fall into the World Health Organization's (WHO) Access category for antibiotics use

AWaRe Classification

The AWaRe classification is a strategic framework developed by the WHO to guide the use of antibiotics in an effort to combat AMR. As an integral part of the WHO's Global Action Plan on AMR, it aims to optimise antibiotic use and improve stewardship practices by categorising antibiotics into three groups: Access, Watch, and Reserve.

The Access category includes the antibiotics that should be widely available and affordable, and are used for first-line treatment of the most common and serious infections. These antibiotics are considered to be safe, effective, and at relatively low risk of leading to AMR when used appropriately. The Watch group contains antibiotics that have a higher potential for developing resistance and should therefore only be prescribed for specific, limited indications in order to reduce the risk of resistance. The Reserve category includes antibiotics that should be used very sparingly and only as a last resort. These antibiotics are reserved for treatment of confirmed or suspected infections caused by multi-drug-resistant organisms, and their use is restricted to ensure they remain effective in the most critical situations.[10]

The AWaRe classification is a crucial tool in the global strategy to manage antibiotic use, mitigate the development of AMR, and safeguard the effectiveness of existing treatments. It supports healthcare providers in making informed decisions about antibiotic prescribing, thus contributing to better patient outcomes and overall public health.

Access

Includes the antibiotics that should be widely available and affordable, serving as the mainstay for treating common and serious infections with a lower risk of AMR.

Watch

Includes the antibiotics that have a higher resistance potential and are recommended as first or second choice treatments but for a limited number of indications.

Reserve

Includes last-resort antibiotics, used sparingly to treat infections from multi-drug-resistant organisms to preserve their efficacy.

Current Trends

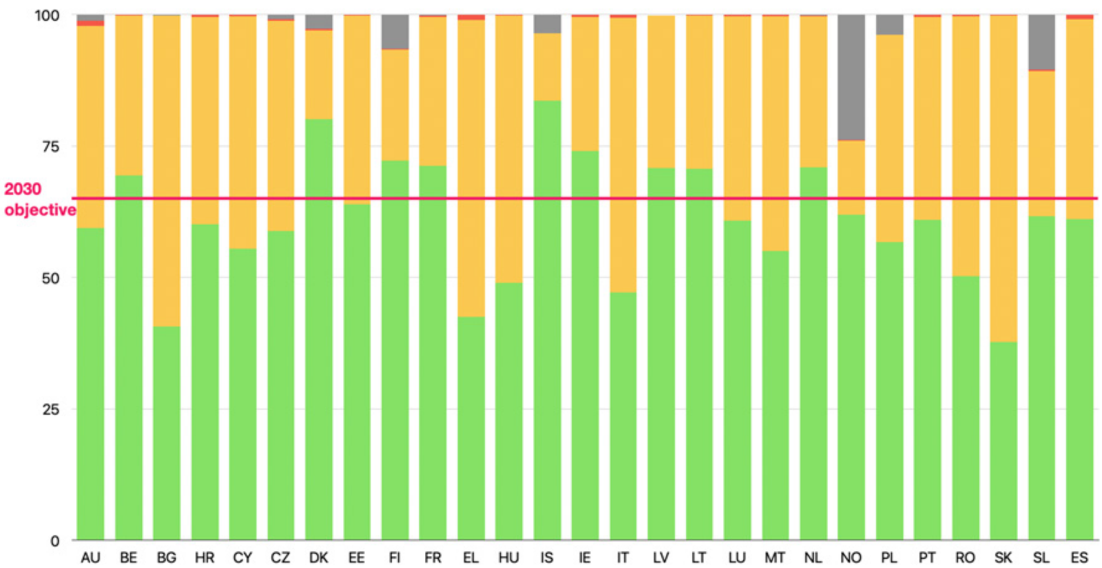
Figure 1 provides an overview of average antibiotic use in the EU/EEA from 2015 to 2022. It shows very gradual progress towards the 2030 target of at least 65% of antibiotics used for humans are from the Access category. Over the eight year timespan shown here, the use of antibiotics from the Access category only increased from 59.5% to 61.0%. While the trend seems to be moving in the right direction, a slight decline in the use of Access antibiotics can be seen from 2019 to 2022 (from 61.5% to 61.0%). On top of that, if over the next eight years the same percentage increase in use of Access antibiotics occurs, by 2030 the 65% target will not be met. The apparent continued use of antibiotics from the Watch, Reserve, and **Unclassified**[a] categories suggests that further efforts are needed to optimise antibiotic prescribing practices across the region.[11]

[a] Consumption of 'Unclassified' mainly consisted of benzathine phenoxymethylpenicillin, combinations of benzylpenicillin/procaine-benzylpenicillin/benzathine-benzylpenicillin and methenamine.

Figure 1. *EU/EEA average antibiotic use according to WHO AWaRe classification, in percentages (2015 – 2022).*

Country-specific data mirrors the slow improvement seen at the regional level, as shown in **Figure 1**. In **Figure 2**, antibiotic use across the Access, Watch, Reserve, and **Unclassified** categories is shown per EU/EEA country in 2022, including the 2030 target of achieving 65% antibiotic use within the Access category. As can be seen, the use of Access category antibiotics varies widely across countries. While Belgium, Denmark, Finland, France, Iceland, Ireland, Latvia, Lithuania and the Netherlands have already met the 65% Access target, many of the other 27 countries still fall significantly short. In Bulgaria, Greece, Hungary, Italy and Slovakia not even 50% of the antibiotics used are from the Access category. The continued high use of antibiotics from the Watch category, which should be minimised, underscores the ongoing challenge of achieving widespread, effective antibiotic stewardship in the EU/EEA. It highlights the necessity for improved stewardship and controlled prescribing practices.[11]

Figure 2. *2022 EU/EEA average antibiotic use according to WHO AWaRe classification, in percentages.*



Key Takeaway

Using the AWaRe classification as part of efforts to combat AMR reflects the EU's commitment to public health, yet challenges remain. If we consider the current AMR trends in the EU and the slow incremental progress from 2015 to 2022 in using **Access** category antibiotics – only a 1.5% increase – than the EU's target of 65% use of **Access** category antibiotics by 2030 may not even be reached. And this target may not even be ambitious enough.

ACTION

The EU's approach, while comprehensive, needs further enhancement to ensure its target will be met. Enhanced antibiotic stewardship, stricter regulations on antibiotic prescriptions, and increased public awareness are critical. Furthermore, the EU could benefit from setting more ambitious targets, especially in countries where the 65% target has already been met, and providing greater support to achieve them. It is also crucial for EU Member States to work together more closely, both within the EU and with others States, harmonising their policies and practices to combat AMR more effectively. Establishing shared targets and goals across all countries would drive uniform policy-making, promote harmonisation, and reduce discrepancies in antibiotic usage between regions. This alignment would ensure that all Member States work towards the same objectives, thereby enhancing the overall effectiveness of AMR strategies. Additionally, collaboration with international bodies to harmonise antibiotic usage policies could also play a key role. By adopting a more ambitious and integrated strategy, the EU can better safeguard the efficacy of existing treatments, reduce the burden of AMR, and protect public health in the long term.

PART 3

DECREASING BLOODSTREAM INFECTIONS CAUSED BY DRUG-RESISTANT MICROORGANISMS

Focusing on three microorganisms that have become resistant to many antibiotics and are the cause of serious infections: MRSA, third-generation cephalosporin-resistant E. coli, and CRKP. By 2030, the EU aims to reduce the total number of bloodstream infections caused by MRSA by 15%, by E. coli by 10%, and by CRKP by 5%, compared to the number of infections in 2019

	Methicillin-resistant Staphylococcus aureus (MRSA)	**3rd gen cephalosporin-resistant E. coli**	**Carbapenem-resistant Klebsiella pneumoniae (CRKP)**
Common location	Human skin and nasal passages	Environment, food, and intestines of humans and animals	Human intestines and the environment
Infection caused	Skin infections which can lead to severe conditions like bloodstream infections, pneumonia, and surgical site infections.	Conditions range from diarrhea to urinary tract infections; resistant strains can lead to bloodstream infections and sepsis.	Can cause severe illnesses such as pneumonia, bloodstream infections, wound or surgical site infections, and meningitis.
Resistant mechanism	It is due to the mecA gene which **changes the** beta-lactam antibiotics' **binding site**, rendering drugs like methicillin ineffective. This gene, often located on the mobile staphylococcal cassette chromosome mec (SCCmec), aids in spreading resistance traits.	Resistance is mainly due to extended-spectrum beta-lactamases (ESBLs), **enzymes that break down** beta-lactam **antibiotics**. The genes for these enzymes, often carried on plasmids, enable rapid spread of resistance among bacteria.	Resistance is developed through the production of carbapenemases (e.g., KPC, NDM, OXA-48), **enzymes that break down** carbapenems and other beta-lactam **antibiotics**, facilitating rapid resistance spread.

Health Impact

Resistant bacteria have a significant impact on the care of patients, especially vulnerable patients with weakened immune systems or severe illnesses. They complicate treatments, increase failure rates, and require last-resort medications. Moreover, resistance raises healthcare costs, extends hospital stays, and increases mortality rates. Resistant bacteria often cause severe complications, such as bloodstream infections, sepsis, and rapid hospital outbreaks, posing major public health challenges and restricting treatment options.[12,13,14,15] Below, a detailed look is taken at the trends in resistance and progress towards reaching the EU's set 2030 targets.

Current Status and Trends

Figure 1 shows the trends in AMR for S. aureus, E. coli and K. pneumoniae from 2017 to 2021 at EU regional level. In 2017, methicillin resistance in S. aureus isolates was 18.4%, gradually decreasing to 15.8% in 2021 (Figure 1, left graph). A 15% decrease in infections with MRSA from 2019, when methicillin resistance in S. aureus was 17.2%, to 2030, would mean 14.6% or less of S. aureus isolates would be methicillin resistant. While the downtrend seen from 2017 to 2021 is promising and suggests that interventions and policies to combat MRSA are having a positive impact, current efforts need to be sustained and evaluated regularly to ensure the 2030 target is met.[16]

In 2017, 15.6% of E. coli isolates were resistant to third-generation cephalosporins (Figure 1, middle graph). In 2018 and 2019, the number of isolates resistant to third-generation cephalosporins stayed about the same, decreasing in 2020 to 14.9% and in 2021 to 13.8%. The EU's target for 2030–to achieve a 10% reduction compared to 2019 levels–would mean that third-generation cephalosporins resistant E. coli levels should be 14.0% lower, levels that had already been reached by 2021.[16]

In 2017, 8.1% of K. pneumoniae isolates were reported to be resistant to carbapenem, with resistance rising to 9.0% in 2019 and 11.7% in 2021 (Figure 1, right graph), illustrating a worrying upward trend. To meet the modest 2030 target of a 5% reduction from the 2019 rates, which translates to a target of 8.6%, urgent and effective measures are crucial to reverse the current trajectory.[16]

Figure 1. Percentage of bacterial isolates with AMR phenotyping in EU/EEA, by bacterial species.

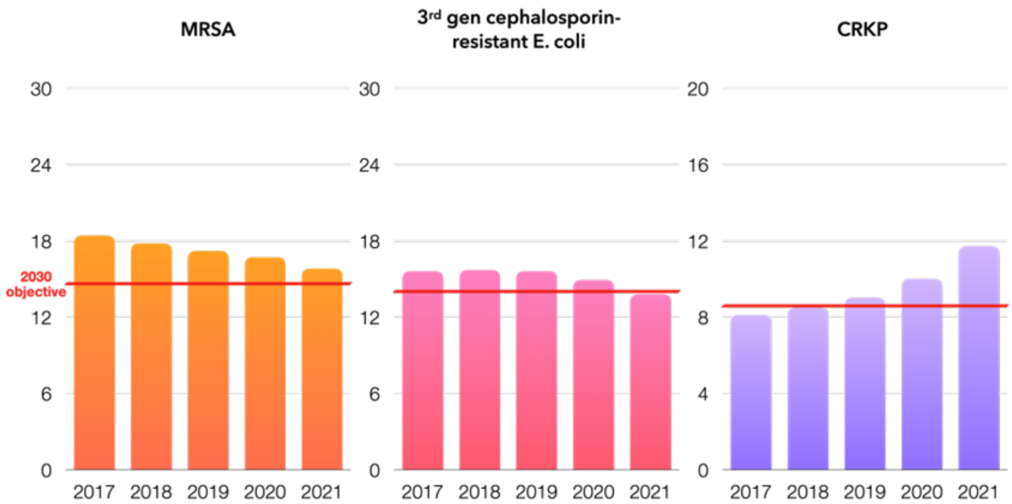


Figure 2 shows the 2019 and 2021 levels of MRSA prevalence per EU/EEA country, as well as the 2030 10% EU reduction target. Four different country-specific reduction targets have been set. Six countries with relatively low incidence of MRSA (between 0.4 and 1.5 per 100,000 population) in 2019, had a target reduction of 3%. For countries with incidence levels ranging between 1.9 and 3.1 per 100,000 population, the target is a 6% reduction. Countries with incidence levels ranging from 3.6 to 5.0 per 100,000 population set a reduction target of 10%, and countries with incidence levels of 5.6 per 100,000 population or higher aim to reduce their consumption by 18%.[8] Twelve of 27 countries (Austria, Belgium, Czechia, Denmark, Estonia, Germany, Ireland, Latvia, Luxembourg, Malta, Portugal and Slovakia) had already reached their reduction target by 2021. On the other hand, nine countries–Bulgaria, Croatia, Cyprus, Finland, Greece, Poland, Slovenia, Spain and Sweden–reported increases in MRSA from 2019 to 2021. Further, the figure shows significant discrepancies in MRSA within the EU, with countries in Northern and Western Europe doing much better in keeping MRSA infections low compared to Eastern and Southern Europe.[16]

Figure 2. Percentage of S. aureus isolates with methicillin-resistant phenotyping in EU/EEA countries in 2019 and 2021, and the 2030 target.

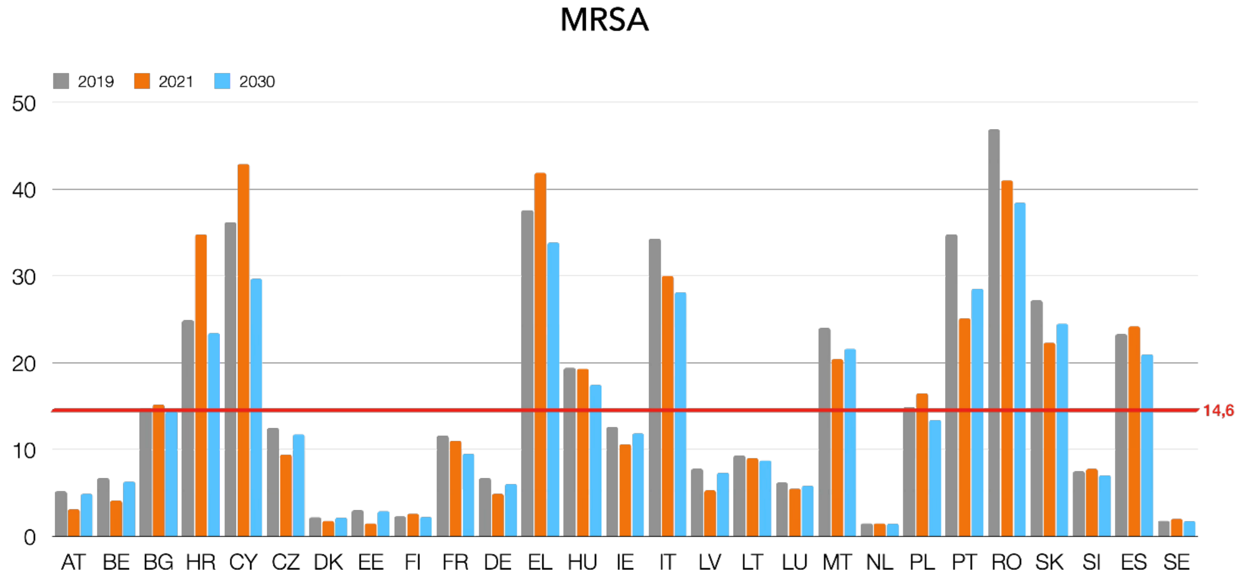


Figure 3 shows the 2019 and 2021 levels of third-generation cephalosporin-resistant E. coli prevalence per EU/EEA country, as well as the 2030 10% EU reduction target. Again, four different country-specific reduction targets have been set. For countries with already relatively low incidence of resistant E. coli (less than 6 per 100,000 population) in 2019, which were Belgium, Croatia, Greece, Latvia and the Netherlands, no reduction was recommended (0%). For countries with incidence levels between 6 and 7 per 100,000 population, the target is a 5% reduction. Countries with incidence levels between 7 and 10 per 100,000 population have a reduction target of 10%, and countries with incidence levels of 12 per 100,000 population or higher need to reduce their consumption by 12%.[8] EU countries seem to be doing well with decreasing infections caused by third-generation cephalosporin-resistant E. coli, as 17 of 27 countries – Austria, Belgium, Bulgaria, Czechia, Denmark, Estonia, Finland, Germany, Hungary, Ireland, Italy, Latvia, Lithuania, Malta, the Netherlands, Portugal and Romania – had already reached their reduction target by 2021. In five countries (Hungary, Cyprus, Greece, Poland and Slovakia) increases in third-generation cephalosporin-resistant E. coli infections were reported from 2019 to 2021. Again, the figure shows significant discrepancies in third-generation cephalosporin-resistant E. coli infections within the EU, with countries in Northern and Western Europe doing better compared to Southern Europe, and much better than Eastern Europe.[16]

Figure 3. Percentage of E. coli isolates with third-generation cephalosporin-resistant phenotyping in EU/EEA countries in 2019 and 2021, and the 2030 target.

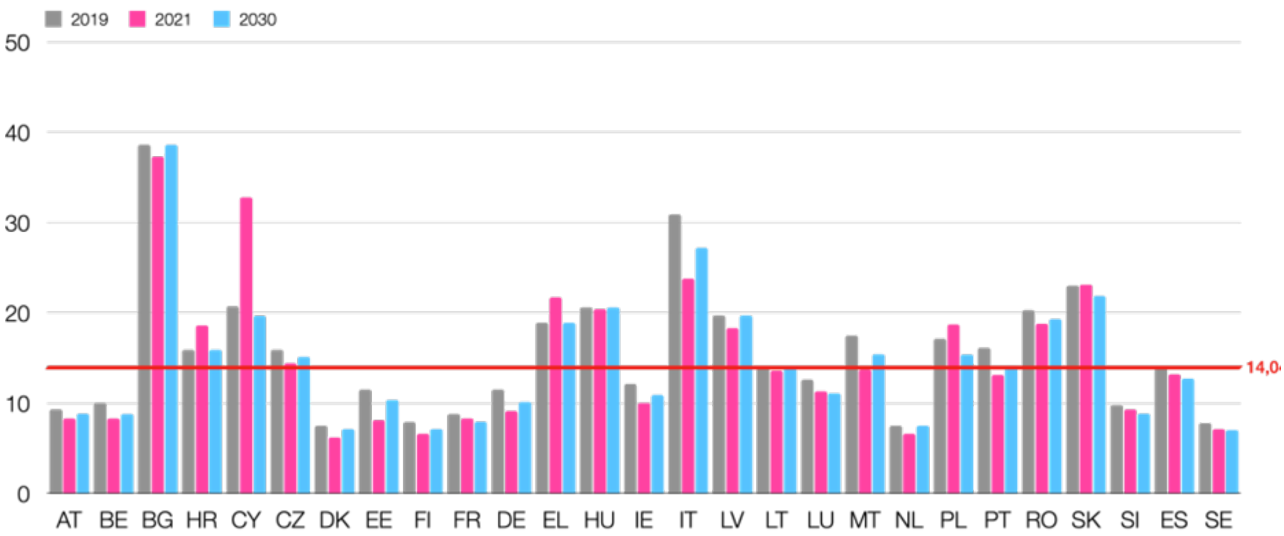
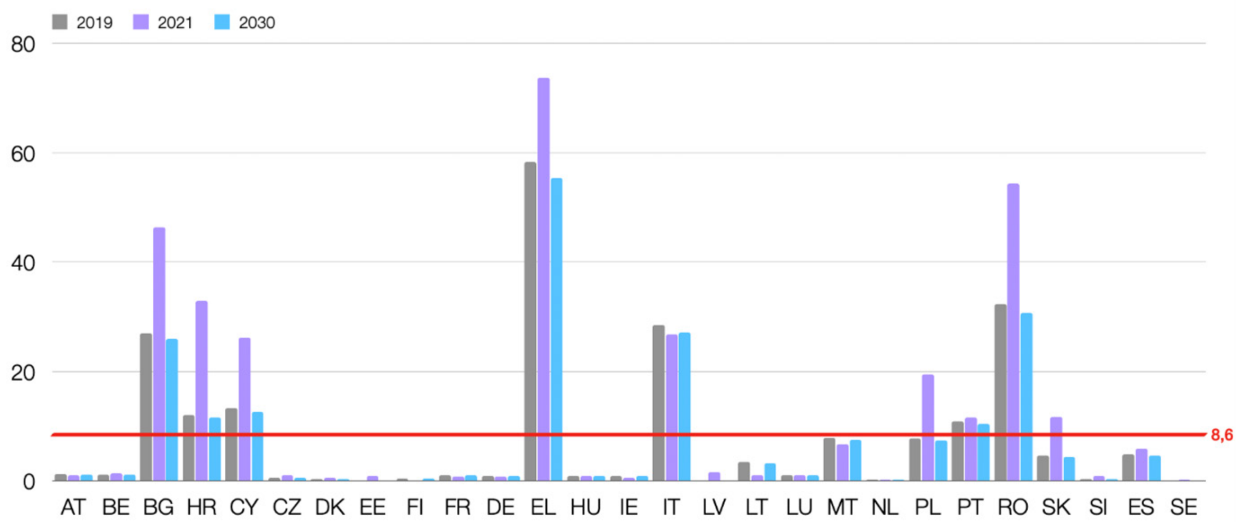


Figure 4 shows the 2019 and 2021 levels of carbapenem-resistant K. pneumoniae prevalence per EU/EEA country, as well as the 2030 5% EU reduction target. Four different country-specific reduction targets were again developed. For countries with very low incidence of resistant K. pneumoniae (less than 0.05 per 100,000 population) in 2019, no reduction was recommended (0%). For countries with incidence levels ranging between 0.05 and 0.27 per 100,000 population, the target is a 2% reduction. Countries with incidence levels ranging from 0.52 to 2.29 per 100,000 population set a reduction target of 4%, and countries with incidence levels of 2.61 per 100,000 population or higher aim to reduce their consumption by 5%.[8] Eighteen of 27 countries are below–or even far below–the EU average target of 8.6%. On the other hand, in seven of the remaining countries (Bulgaria, Croatia, Cyprus, Greece, Italy, Poland and Romania) the levels of carbapenem-resistant K. pneumoniae are far above the average EU levels, highlighting a significant problem with this type of resistance in K. pneumoniae in Eastern Europe and parts of Southern Europe.[16]

Figure 4. Percentage of K. pneumoniae isolates with carbapenem-resistant phenotyping in EU/EEA countries in 2019 and 2021, and the 2030 target.



Key Takeaways

The data on AMR resistance among three types of bacteria shown here suggest that the EU's strategy against AMR, while comprehensive, can benefit from a critical assessment of its ambitions. The successes booked by multiple countries in exceeding the 2030 targets by 2021 raises the question about the ambitiousness of these targets. Nevertheless, the decision to establish specific targets reflects a significant step forward in addressing a longstanding call from healthcare professionals, researchers, policy makers and advocates.[17] This proactive approach is commendable as it aligns with recommendations from various stakeholders who have long emphasised the need for quantifiable and ambitious goals to combat the spread of AMR effectively.[18]

As shown here, the challenge of addressing AMR is not uniform across the EU, and the set targets, while providing a clear directive for national efforts, might not catch the complexity of achieving these goals for all countries. The difficulty in reducing AMR rates varies significantly depending on the baseline levels of resistance. For instance, reducing resistance from 18% to 16% might not present the same level of challenge as reducing it from 5% to 2%. This disparity highlights the need for a more tailored approach in setting and pursuing national targets.

It is also important to note that the current EU targets focus on only three critical microorganisms — S. aureus, E. coli and K. pneumoniae. This narrow focus does not fully address the spectrum of AMR, as many other pathogens also pose significant threats due to their resistance capabilities. Additionally, even within these three targeted microorganisms, the set goals do not tackle all types of resistances. For instance, while there have been successes in reducing resistance to certain types of antibiotics, other antibiotic-resistant strains remain a serious concern, underlining the need for more comprehensive and diverse targets.

ACTION

While the EU's efforts in combating AMR are significant and have shown promising results, a broader and more ambitious approach is necessary. Setting more ambitious targets, as well as expanding the scope of targeted pathogens and addressing the full range of resistances, will be crucial in effectively combating AMR and safeguarding public health.

Limitations

The European Council has set a target to reduce the incidence of AMR. However, we were unable to access the specific incidence data required to align our calculations with those of the EU. Consequently, our efforts to calculate the incidence did not match the EU's figures. To simplify and make our findings more understandable for the reader, we provided the percentage of AMR among all isolates. The targets were then calculated based on these percentages.

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