SURVEILLANCE REPORT

Antimicrobial consumption in the EU/EEA

Annual Epidemiological Report for 2019

Key facts

- In 2019, the average total (community and hospital sector combined) consumption of antibacterials for systemic use (Anatomical Therapeutic Chemical (ATC) group J01) in the EU/EEA was 19.4 defined daily doses (DDD) per 1 000 inhabitants per day (country range: 9.5–34.1). During the period 2010–2019, a statistically significant decrease was observed for the EU/EEA overall. Statistically significant decreasing trends were observed for 13 countries. Statistically significant increasing trends were observed for four countries.
- The average consumption of antivirals for systemic use (ATC group J05) in both sectors (total (community and hospital sector combined) was 2.3 DDD per 1 000 inhabitants per day (country range: 0.3–6.8).
- Thirty countries – 28 EU Member States and two EEA countries (Iceland and Norway) – reported data on antimicrobial consumption for 2019. Twenty-five countries reported both community and hospital consumption, three countries (Austria, Germany and Iceland) reported only community consumption, and two countries (Cyprus and Czechia) reported total consumption for both sectors combined.
- Antimicrobial consumption is expressed as the number of DDD per 1 000 inhabitants per day. The ATC DDD Index 2020 was used for the analysis of 2019 data as well as of historical data in order to assess 10-year trends.
- The most recent data on antimicrobial consumption, as well as historical data (1997–2019) are available from the public ESAC-Net interactive database on ECDC's website.

Community (primary care sector)

- In the community, the average consumption of antibacterials for systemic use (ATC group J01) was 18.0 DDD per 1 000 inhabitants per day (country range: 8.7–32.4). During the period 2010–2019, no statistically significant change was observed for the EU/EEA overall. However, statistically decreasing trends were observed for 12 countries (Austria, Belgium, Denmark, Finland, Germany, Italy, Luxembourg, the Netherlands, Norway, Slovenia, Spain and Sweden). Statistically significant increasing trends were observed for six countries (Bulgaria, Greece, Iceland, Ireland, Latvia and Poland).
- The average ratio of consumption of broad-spectrum penicillins, cephalosporins, macrolides (except erythromycin) and fluoroquinolones to the consumption of narrow-spectrum penicillins, cephalosporins and macrolides (i.e. erythromycin) in the community was 2.8 (country range: 0.1–20.1). During the period 2010–2019, statistically significant increasing trends were observed for the EU/EEA overall and for 10 countries (Bulgaria, Croatia, Cyprus, Estonia, Hungary, Italy, Latvia, Lithuania, Slovakia and the United Kingdom), and statistically significant decreasing trends were observed for eight countries (Belgium, Finland, France, Germany, Ireland, Luxembourg, the Netherlands and Norway).
- The average consumption of antimycotics and antifungals for systemic use (ATC groups J02 and D01B) in the community was 1.0 DDD per 1 000 inhabitants per day (country range: 0.4–3.0).

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Hospital sector

- In the hospital sector, the average consumption of antibacterials for systemic use (ATC group J01) was 1.8 DDD per 1 000 inhabitants per day (country range: 0.8–2.5). During the period 2010–2019, no statistically significant change was observed for the EU/EEA overall. However, statistically significant decreasing trends were observed for seven countries (Belgium, Finland, Latvia, Luxembourg, the Netherlands, Norway and Spain), and statistically significant increasing trends were observed for six countries (Bulgaria, Croatia, Ireland, Lithuania, Malta and the United Kingdom).
- The average consumption of carbapenems in the hospital sector was 0.04 DDD per 1 000 inhabitants per day (country range: 0.01–0.13), and no statistically significant change was observed for the EU/EEA overall between 2010 and 2019. However, statistically significant increasing trends were observed for 11 countries (Bulgaria, Croatia, Denmark, Estonia, Greece, Hungary, Lithuania, Malta, the Netherlands, Poland and Slovakia) between 2010 and 2019, and statistically significant decreasing trends were observed for two countries (Norway and Portugal) during the same period.
- The average consumption of polymyxins in the hospital sector was 0.01 DDD per 1 000 inhabitants per day (country range: <0.001–0.08), and consumption increased significantly between 2010 and 2019. Statistically significant increasing trends were observed for 10 countries (Bulgaria, Denmark, Hungary, Greece, Italy, Latvia, Norway, Slovakia, Spain and the United Kingdom), and statistically significant decreasing trends were reported for two countries (Ireland and the Netherlands).
- The average proportion of glycopeptides, third- and fourth-generation cephalosporins, monobactams, carbapenems, fluoroquinolones, polymyxins, piperacillin and enzyme inhibitor, linezolid, tedizolid and daptomycin consumption out of total consumption of antibacterials for systemic use in the hospital sector was 33.7% (country range: 16.6-58.5%). During the period 2010–2019, statistically significant increasing trends were observed for the EU/EEA overall and seven countries specifically, whereas one country showed a statistically significant decreasing trend.
- The average consumption of antimycotics and antifungals for systemic use (ATC groups J02 and D01B) in the hospital sector was 0.12 DDD per 1 000 inhabitants per day (country range: 0.03–0.21).

** Important note: data were updated using the ATC/DDD Index 2020, which included several DDD alterations implemented in 2019. Data in this report should therefore not be compared with data reported by ECDC prior to 2019. For the most recent data on antimicrobial consumption and trends in EU/EEA countries, readers should instead refer to the most recent report or the ESAC-Net interactive database.*

Methods

This report is based on data for 2019 retrieved from The European Surveillance System (a system for the collection, storage, analysis and dissemination of data on communicable diseases) on 9 November 2020. For a detailed description of methods used to produce this report, please refer to the methods chapter in the introduction to the ECDC Annual Epidemiological Report [1].

An overview of national surveillance systems is available online [2]. A subset of the data used for this report is available through ECDC's online antimicrobial consumption database (ESAC-Net) [3].

This surveillance report included antimicrobial consumption data reported by 28 EU Member States and two EEA countries (Iceland and Norway). The data sources for antimicrobial consumption were the same as in the previous report from ESAC-Net.

Antimicrobial consumption data are collected using the Anatomical Therapeutic Chemical (ATC) classification system and defined daily dose (DDD) methodology developed by the WHO Collaborating Centre for Drug Statistics Methodology (Oslo, Norway). For the analysis, DDDs listed in the ATC Index for 2020 were used [4]. One DDD is the assumed average maintenance dose per day for a drug used in its main indication in adults. It is a technical unit of measurement, not a standard for appropriate use. Application of the ATC/DDD methodology makes it possible to aggregate different brands of medicines with different pack sizes and strengths into units of measurement of active substances. It represents a standard in performing valid and reliable cross-national or longitudinal studies of antimicrobial consumption. DDD values of some medicines may change over time because of alterations in the main indication, or regulatory amendments for the recommended or prescribed daily dose. In case of such changes, all historical data require retrospective adjustments to the latest DDD/ATC index [4].

The European Surveillance System database allows for correction and re-uploading of historical data by the reporting countries. Therefore, the latest published reports supersede previous reports and reflect the most recent available data.

There are three major categories of antimicrobials under surveillance:

- antibacterials for systemic use (ATC group J01);
- antimycotics and antifungals for systemic use (ATC groups J02 & D01B);
- antivirals for systemic use (ATC group J05).

Due to the structure of the ATC classification, some antibacterials under surveillance are classified in ATC groups other than J01. For example, vancomycin and fidaxomicin for oral administration are classified as intestinal anti-infectives in ATC group A07A, and are used against *Clostridioides* (*Clostridium*) *difficile* infections. Metronidazole, which may also be orally administered against C*. difficile*, is classified as an agent against amoebiasis and other protozoal diseases in ATC group P01A. Rifampicin is classified as a drug for the treatment of tuberculosis (ATC group J04A). In clinical practice, rifampicin is also used for *Haemophilus influenzae* infections or in combination with other antibacterials to treat meticillin-resistant *Staphylococcus aureus* (MRSA) infections, brucellosis, Legionnaires' disease and serious staphylococcal infections.

Consumption data were collected for the community (primary care) sector and the hospital (secondary care and tertiary care) sector as a detailed list of all available antimicrobial products (register) and the annual number of packages consumed, or, if unavailable, as the number of DDD per ATC substance and route of administration. Consumption of antibacterials for systemic use and of antimycotics and antifungals for systemic use are presented separately for the community and the hospital sector, while for consumption of antivirals for systemic data for the community and the hospital sector are combined.

The indicator 'defined daily doses (DDD) per 1 000 inhabitants per day' is used to report antibiotic consumption in the community (i.e. outside hospitals) [4,5]. It provides a rough estimate of the proportion of the population treated daily with antimicrobials. The indicator 'DDD per 1 000 inhabitants per day' is also used to report antibiotic consumption in the hospital sector, although another indicator, i.e. 'DDD per 100 occupied bed-days', has been recommended for reporting hospital consumption [4,6]. This is because uniformly defined denominator data on the total number of occupied bed-days are currently unavailable for all EU/EEA countries. In addition, presenting data with the same denominator enables cross-sectoral comparison.

The indicator 'DDD per 1 000 inhabitants per day' has also been selected as the primary harmonised outcome indicator by ECDC, the European Food Safety Authority (EFSA) and the European Medicines Agency (EMA) to describe total antimicrobial consumption in humans, combining both the community and hospital sectors [7].

Likewise, the pattern of antimicrobial consumption was selected as a secondary harmonised outcome indicator for AMC after agreement of an expert group convened by ECDC, EFSA and EMA, and on request from the European Commission. For the community, the agreed indicator is the ratio of consumption of broad-spectrum penicillins, cephalosporins, macrolides (except erythromycin) and fluoroquinolones to the consumption of narrow-spectrum penicillins, cephalosporins and erythromycin. For the hospital sector, the agreed indicator is the proportion of glycopeptides, 3rd- and 4th-generation cephalosporins, monobactams, carbapenems, fluoroquinolones, polymyxins, piperacillin and enzyme inhibitor, linezolid, tedizolid and daptomycin out of the total hospital consumption of antibacterials for systemic use.

In addition, the 'consensus-based quality indicators', published in 2007 by the European Surveillance of Antimicrobial Consumption (ESAC) project were applied to describe antimicrobial consumption [8].

Data analysis

For each country, antimicrobial consumption expressed as DDD per 1 000 inhabitants per day is displayed in all tables and figures of the report as reported by the country to The European Surveillance System. In the tables, missing data for a specific year are displayed as an empty cell.

Population-weighted mean

Antimicrobial consumption displayed with the label 'EU/EEA' and presenting only 2019 data is based on the data reported for a year and a selected ATC group or subgroup. All EU/EEA means are population-weighted and calculated by multiplying DDD per 1 000 inhabitants per day for each country with the corresponding Eurostat population, and dividing the product by the total population of all participating EU/EEA countries.

Trend analysis

To assess whether the EU/EEA 10-year trend of consumption for ATC group J01 and subgroups (5-year trend for ATC J05) was statistically significant, linear regression was applied. Missing values for country specific univariate time series were imputed by one of the following interpolation methods: linear interpolation, Spline regression or weighted moving average algorithms (where the missing values are replaced by moving average values). The imputation allows for inclusion of the same number of EU/EEA countries for all the years in the trend analyses. Imputing missing values was performed using the R package 'imputeTS'.

In cases in which a country only reported aggregated community and hospital sector data ('total care') for a specific year, the value was corrected using mean distribution between hospital and community sector obtained

from the other years in the studied period. If the country had not reported separate community and hospital data for any of the years during the studied time period (e.g. Iceland), the EU/EEA average proportions were used.

For Czechia, total care was reported from the Czech Medicines Agency for 2019 were adjusted proportionally compared with data reported for 2010-2015 where the data had been reported from National Statistics Agency.

For Spain, the community consumption data reported for the years 2010-2015 were adjusted proportionally due to the change in reported data sources from 2016 onwards. Spain changed reporting from reimbursement data to sales data, which resulted in a substantial technical increase of antimicrobial consumption compared with previous years, as the reimbursement data included consumption without a prescription and other non-reimbursed courses.

Compound annual growth rate

To illustrate changes in rates in antimicrobial consumption over time, we calculated the compound annual growth rate (CAGR) of total antibiotic consumption by each country [9]. It displays the average annual change as a proportion (%) of the consumption in the starting year.

More details on the methods, collection, validation and reporting of European antimicrobial consumption data are available from the ESAC-Net pages on ECDC's website. They are also described in the ESAC-Net surveillance reports [10]. The most recent data on antimicrobial consumption are available from the public ESAC-Net interactive database (data for 1997–2019) on ECDC's website [3].

Antimicrobial consumption

All EU Member States and two EEA countries (Iceland and Norway) reported data on antimicrobial consumption for 2019. Twenty-five countries reported both community and hospital consumption, three countries (Austria, Germany and Iceland) reported only community consumption, and two countries (Cyprus and Czechia) reported total consumption for both sectors combined. Data from Cyprus and Czechia are shown together with community consumption from other countries because, on average, approximately 90% of the total consumption data of antibacterials for systemic use (ATC group J01) refer to consumption in the community.

For the first time, Czechia reported antimicrobial consumption data including hospital sector data; these data were sales data and reported as total consumption (community and hospital sector combined). For the first time, Romania reported antimicrobial consumption data separately for the community and the hospital sector. For the United Kingdom (UK), data refer to antimicrobial consumption in England, Northern Ireland and Scotland only.

For both the community and the hospital sector, consumption data were mainly based on sales of antimicrobials in the country or a combination of sales and reimbursement data.

Total consumption (community and hospital sector) of antibacterials for systemic use (ATC group J01)

ECDC/EFSA/EMA primary indicator for total consumption of antibacterials for systemic use (ATC group 01) in humans

In 2019, the average total consumption (community and hospital sector combined) of antibacterials for systemic use (ATC group J01) in the EU/EEA was 19.4 DDD per 1 000 inhabitants per day, ranging from 9.5 in the Netherlands to 34.1 in Greece. During the period 2010–2019, a statistically significant decrease was observed for the EU/EEA overall. Statistically significant decreasing trends were observed for 13 countries and statistically significant increasing trends were observed for four countries (Table1).

Table 1. Total consumption (community and hospital sector) of antibacterials for systemic use (ATC group J01), by country, EU/EEA, 2010–2019 (expressed as DDD per 1 000 inhabitants per day)

Country	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	Trends in antimicrobial consumption, 2010–2019	CAGR Compound annual growth rate (%)	Trend
Austria	13.1*	12.7*	12.2*	14.2*	12.1*	12.1*	11.4*	11.9*	10.4*	9.9*		-3.1%	↓
Belgium	24.9	25.4	25.6	24.2	24.0	24.4	24.2	22.8	22.3	21.3		-1.7%	↓
Bulgaria	17.2	18.3	17.4	18.6	20.0	20.1	19.2	20.5	21.0	20.7		2.1%	↑
Croatia	18.8	18.2	20.0	19.2	19.4	19.7	18.7	18.6	18.8	18.8		0.0%	
Cyprus	26.3	26.9	25.1	23.9	22.2	26.6	28.4	28.9	28.0	30.1		1.5%	
Czechia	16.0*	16.5*	15.7*	16.9*	17.1*	17.4*				16.9		N/A	
Denmark	17.5	18.3	17.4	17.5	17.1	17.5	17.0	16.2	15.6	15.3		-1.5%	↓
Estonia	11.4	12.4	12.2	12.0	11.9	12.1	12.0	11.6	11.8	11.8		0.3%	
Finland	19.7	21.5	20.6	19.6	19.1	18.1	17.4	15.7	15.5	14.7		-3.2%	↓
France	25.0	25.1	25.7	25.9	24.9	25.6	25.6	24.7	25.3	25.1		0.0%	
Germany	13.4*	13.1*	13.7*	14.5*	13.4*	13.1*	12.8*	12.3*	11.9*	11.4*		-1.8%	↓
Greece	35.6	33.4	29.9	29.8	31.0	33.2	33.1	34.2	34.0	34.1		-0.5%	
Hungary	14.8	14.9	14.1	14.5	15.2	15.8	14.4	14.6	14.8	14.4		-0.3%	
Iceland	19.8	19.8	19.7	19.4	17.1*	17.6*	18.2*	18.8*	20.4*	19.5*		2.7%	↑
Ireland	19.0	20.8	21.0	21.6	21.0	23.0	22.0	20.9	22.7	22.8		2.1%	↑
Italy	24.9	25.1	24.6	25.2	24.5	24.5	24.0	20.9	21.4	21.7		-1.5%	↓
Latvia	12.6	12.9	12.9	13.3	12.6	13.1	12.9	13.9	13.3	13.9		1.1%	↑
Lithuania	14.4	15.5	15.3	17.1	15.1	15.8	15.6	15.7	17.5	15.6		0.9%	
Luxembourg	25.1	25.2	25.0	25.0	23.2	23.5	22.9	22.6	22.2	21.1		-1.9%	↓
Malta	19.9	21.6	20.8	22.2	22.4	21.2	20.9	22.6	20.9	20.7		0.4%	
Netherlands	10.9	11.0	10.9	10.5	10.3	10.4	10.1	9.8	9.7	9.5		-1.6%	↓
Norway	16.8	17.5	17.9	17.2	16.9	16.8	16.2	15.7	15.3	14.9		-1.3%	↓
Poland	18.0*	18.2*	19.9*	20.5*	21.2	24.1	22.0	25.4	24.4	23.6		2.2%	
Portugal	19.9	20.6	20.1	17.6	18.0	18.8	19.0	18.3	18.6	19.3		-0.4%	
Romania		26.5	25.9	26.8	26.6	28.0	24.4	24.5	25.0	25.8		-0.3%	
Slovakia		21.4*	19.7	23.2	21.2	24.2	23.6	20.0	22.0	19.3		-0.3%	
Slovenia	13.4	13.4	13.2	13.3	13.1	13.3	13.0	13.1	13.2	13.0		-0.3%	↓
Spain	16.2†	16.6†	15.7†	16.2†	17.1†	17.5†	27.5	26.8	26.3	24.7		-3.4%	↓
Sweden	15.2	15.4	15.3	14.2	14.0	13.5	13.2	12.8	12.4	11.8		-2.8%	↓
United Kingdom	16.5*	16.5*	17.7*	20.4	20.8	20.1	19.7	19.3	18.8	18.2††		-1.9%	↓
EU/EEA	**20.9**	**20.9**	**21.0**	**21.5**	**21.1**	**21.5**	**20.7**	**20.2**	**20.1**	**19.4**		**-0.4%**	↓

All country data are shown as they are reported to The European Surveillance System.
** = countries reported only community data, † = Spain reported 2010-2015 reimbursement data and changed in 2016 to sales data; †† = UK contributed 2019 data from England, Northern Ireland and Scotland only; N/A = not applicable.*

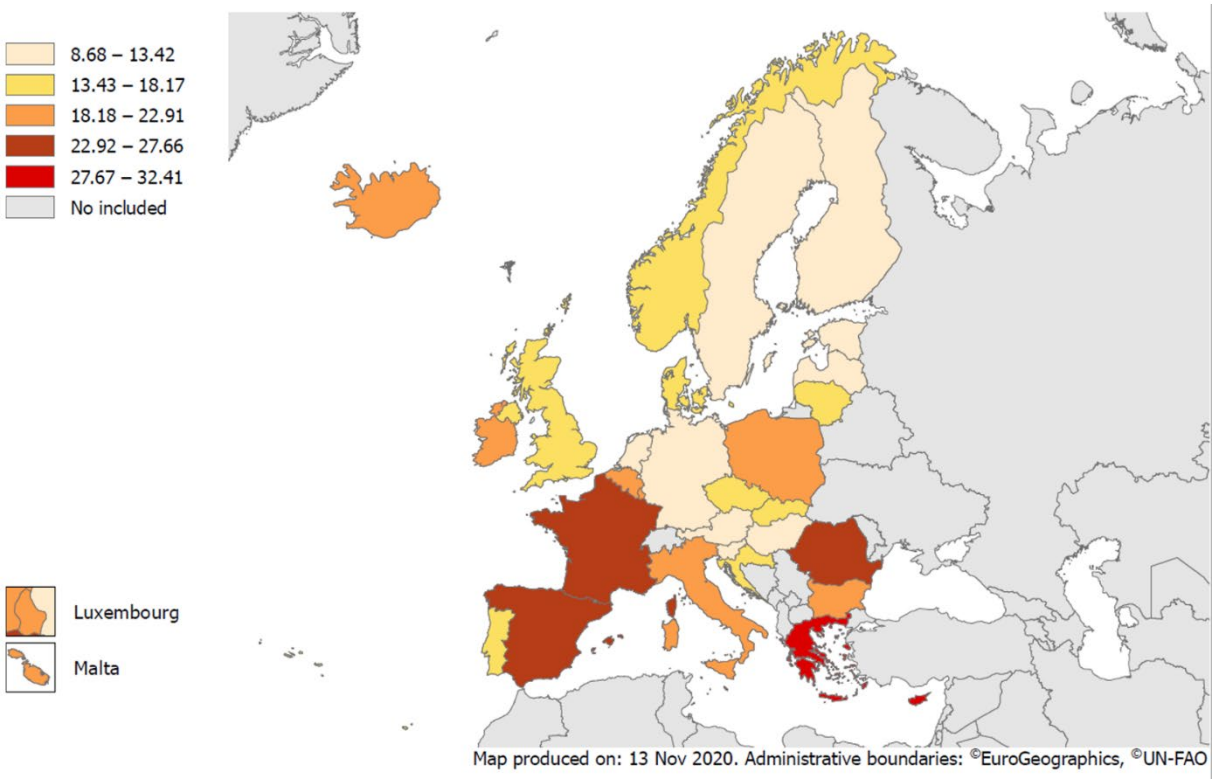
[light shaded cells] = linear regression was not applied for the highlighted cells, because of missing data, changes in the type of data or changes of sector for which data were reported (community versus total care data).

EU/EEA refers to the corresponding population-weighted mean consumption based on reported antimicrobial consumption data of all 30 EU/EEA countries. Through imputation, proportional adjustments for countries who changed the data source during this period (Czechia, Spain) and using EU/EEA average proportions if countries had not reported separate community and hospital data for any of the years during the studied time period (e.g. for Iceland), the EU/EEA averages include the same number of EU/EEA countries for all years of the trend analyses (see the method chapter).

Consumption of antibacterials for systemic use (ATC group J01) in the community

In 2019, the EU/EEA population-weighted mean consumption of antibacterials for systemic use in the community (i.e. outside hospitals) was 18.0 DDD per 1 000 inhabitants per day, ranging from 8.7 in the Netherlands to 32.4 in Greece (Figure 1).

Figure 1. Consumption of antibacterials for systemic use (ATC group J01) in the community, EU/EEA countries, 2019 (expressed as DDD per 1 000 inhabitants per day)



Cyprus and Czechia provided total care data (i.e. including the hospital sector).
The UK contributed 2019 data from England, Northern Ireland and Scotland only.

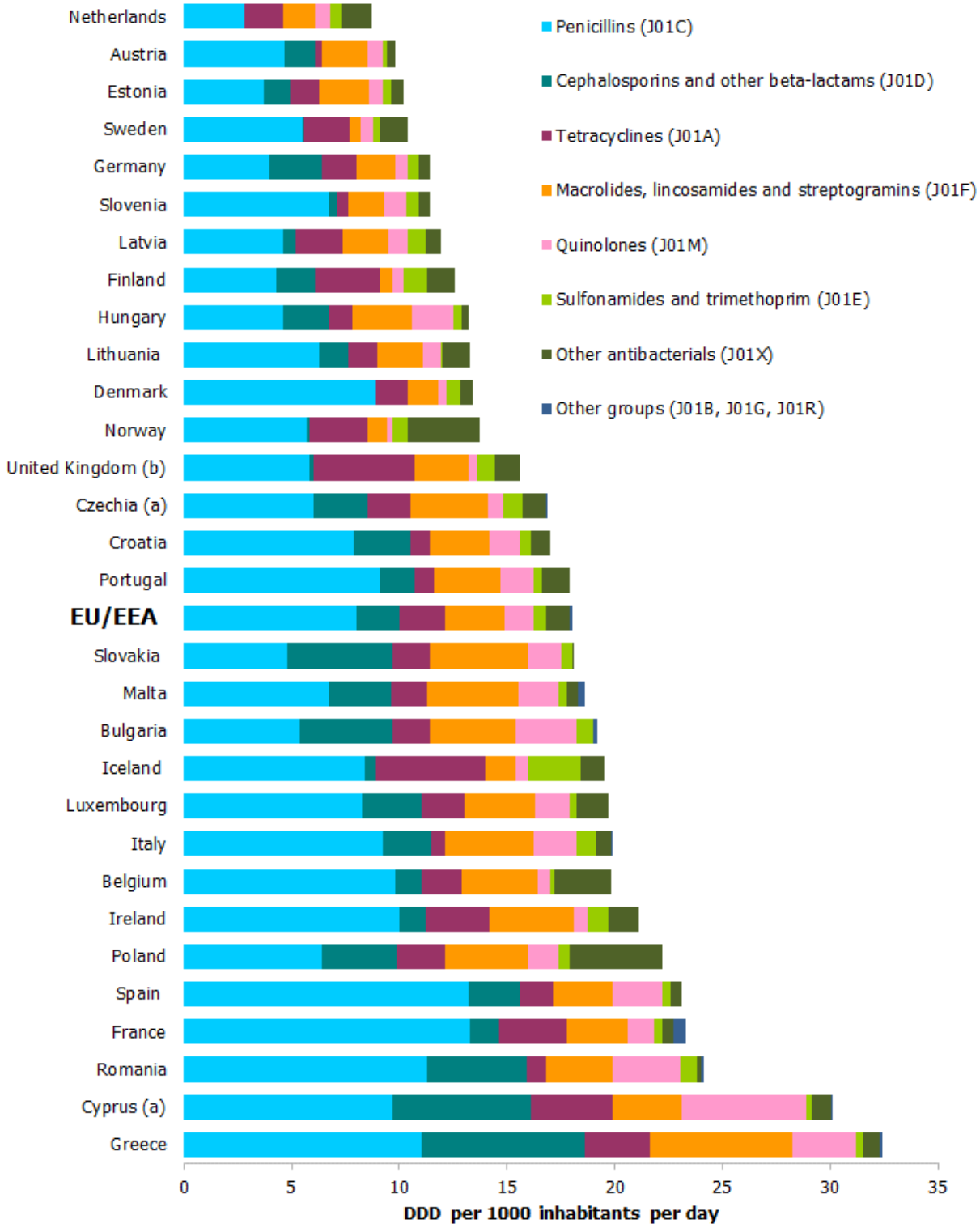
Consumption of major subgroups of antibacterials for systemic use (ATC group J01) in the community in 2019 is presented in Table 2 and Figure 2. Penicillins (ATC group J01C) were the most frequently used antibacterials in all but one country (Slovakia), and their proportion ranged from 27% (Slovakia) to 66% (Denmark) of the total consumption in the community. The proportion of other antibacterial groups varied more widely between countries. For example, cephalosporins and other beta-lactams (ATC group J01D) ranged from 0.2% in Denmark to 27% in Slovakia; macrolides, lincosamides and streptogramins (ATC group J01F) ranged from 5% in Finland to 26% in Slovakia; and quinolone antibacterials (ATC group J01M), from 2% in Norway to 19% in Cyprus (reporting total care data).

Table 2. Consumption of antibacterials for systemic use (ATC group J01) in the community, by country and ATC group level 3, EU/EEA , 2019 (expressed as DDD per 1 000 inhabitants per day)

Country	Tetracyclines (J01A)	Beta-lactams, penicillins (J01C)	Other beta-lactam anti-bacterials (J01D)	Sulfonamides and trimethoprim (J01E)	Macrolides, lincosamides and streptogramins (J01F)	Quinolones (J01M)	Other anti-bacterials (J01X)	Other groups (J01B, J01G, and J01R)*	Total (ATC group J01)
Austria	0.3	4.7	1.4	0.2	2.1	0.7	0.4	0.0	9.9
Belgium	1.9	9.8	1.2	0.2	3.5	0.6	2.6	0.0	19.8
Bulgaria	1.7	5.4	4.3	0.8	4.0	2.8	0.0	0.2	19.1
Croatia	0.9	7.9	2.6	0.5	2.8	1.4	0.9	0.0	16.9
Cyprus *(a)*	3.8	9.7	6.4	0.2	3.2	5.8	0.9	0.1	30.1
Czechia *(a)*	2.0	6.0	2.5	0.9	3.6	0.7	1.1	0.1	16.9
Denmark	1.5	8.9	0.0	0.6	1.4	0.4	0.6	0.0	13.4
Estonia	1.4	3.7	1.2	0.4	2.3	0.6	0.6	0.0	10.2
Finland	3.0	4.3	1.8	1.1	0.6	0.5	1.3	0.0	12.6
France	3.2	13.3	1.3	0.4	2.8	1.2	0.5	0.6	23.3
Germany	1.6	4.0	2.4	0.5	1.8	0.6	0.5	0.0	11.4
Greece	3.0	11.0	7.6	0.3	6.6	3.0	0.8	0.1	32.4
Hungary	1.1	4.6	2.1	0.4	2.8	1.9	0.3	0.0	13.3
Iceland	5.1	8.4	0.5	2.4	1.4	0.6	1.1	0.0	19.5
Ireland	3.0	10.0	1.2	1.0	3.9	0.6	1.4	0.0	21.0
Italy	0.6	9.2	2.3	0.9	4.1	2.0	0.7	0.1	19.8
Latvia	2.2	4.6	0.6	0.8	2.1	0.9	0.7	0.0	12.0
Lithuania	1.4	6.3	1.3	0.1	2.1	0.8	1.3	0.0	13.4
Luxembourg	2.0	8.3	2.7	0.3	3.3	1.6	1.5	0.0	19.8
Malta	1.7	6.7	2.9	0.4	4.2	1.9	0.5	0.3	18.7
Netherlands	1.8	2.8	0.0	0.5	1.5	0.7	1.4	0.0	8.7
Norway	2.7	5.7	0.1	0.7	0.9	0.3	3.3	0.0	13.6
Poland	2.2	6.4	3.5	0.5	3.9	1.4	4.3	0.0	22.2
Portugal	0.9	9.1	1.6	0.4	3.1	1.5	1.3	0.0	17.9
Romania	0.9	11.3	4.6	0.8	3.1	3.1	0.2	0.1	24.0
Slovakia	1.7	4.8	4.9	0.5	4.6	1.5	0.1	0.0	18.0
Slovenia	0.5	6.7	0.4	0.6	1.7	1.0	0.5	0.0	11.5
Spain	1.5	13.2	2.4	0.4	2.8	2.3	0.5	0.0	23.1
Sweden	2.1	5.5	0.1	0.3	0.5	0.6	1.3	0.0	10.3
UK*(b)*	4.7	5.8	0.2	0.8	2.5	0.4	1.2	0.0	15.6
EU/EEA	**2.1**	**8.0**	**2.0**	**0.6**	**2.8**	**1.3**	**1.1**	**0.1**	**18.0**

(a) Cyprus and Czechia provided total care data (i.e. including the hospital sector).
(b) The UK contributed 2019 data from England, Northern Ireland and Scotland only.
**J01B: Amphenicols; J01G: Aminoglycoside antibacterials; J01R: Combinations of antibacterials.*
EU/EEA refers to the corresponding population-weighted mean consumption based on reported data for 2019.

Figure 2. Consumption of antibacterials for systemic use (ATC group J01) in the community, by country and ATC group level 3, EU/EEA, 2019 (expressed as DDD per 1 000 inhabitants per day)



(a) Cyprus and Czechia provided total care data (i.e. including the hospital sector).
(b) The UK contributed 2019 data from England, Northern Ireland and Scotland only.
EU/EEA refers to the corresponding population-weighted mean consumption based on the reported data for 2019.

The EU/EEA population-weighted mean consumption of antibacterials for systemic use decreased from 18.9 DDD per 1 000 inhabitants per day in 2010 to 18.0 in 2019, but there was no statistically significant trend for the 10-year period 2010–2019 (Table 3). During the same period, statistically decreasing trends were observed for 12 countries (Austria, Belgium, Denmark, Finland, Germany, Italy, Luxembourg, the Netherlands, Norway, Slovenia, Spain and Sweden), and statistically significant increasing trends were observed for six countries (Bulgaria, Greece, Iceland, Ireland, Latvia, Poland).

Table 3. Trends in consumption of antibacterials for systemic use (ATC group J01) in the community, by country, EU/EEA. 2010–2019 (expressed as DDD per 1 000 inhabitants per day)

Country	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	Trends in antimicrobial consumption, 2010–2019	CAGR Compound annual growth rate (%)	Trend
Netherlands	10.0	10.1	10.1	9.6	9.4	9.5	9.2	8.9	8.9	8.7		-1.6%	↓
Austria	13.1	12.7	12.2	14.2	12.1	12.1	11.4	11.9	10.4	9.9		-3.1%	↓
Estonia	9.8	10.7	10.3	10.3	10.2	10.5	10.4	9.9	10.2	10.2		0.5%	
Sweden	13.8	13.9	13.7	12.7	12.5	11.9	11.7	11.3	10.8	10.3		-3.1%	↓
Germany	13.4	13.1	13.7	14.5	13.4	13.1	12.8	12.6	11.7	11.4		-1.8%	↓
Slovenia	11.8	11.9	11.8	11.9	11.6	11.9	11.5	11.6	11.7	11.5		-0.3%	↓
Latvia	9.9	10.8	11.0	11.3	10.6	11.1	11.1	12.1	11.5	12.0		2.1%	↑
Finland	17.0	18.6	18.0	16.9	16.6	15.8	15.0	13.6	13.2	12.6		-3.3%	↓
Hungary	13.6	13.8	13.0	13.4	14.0	14.7	13.3	13.4	13.7	13.3		-0.3%	
Denmark	15.9	16.7	15.7	15.7	15.2	15.3	15.2	14.3	13.6	13.4		-1.8%	↓
Lithuania	14.4*	15.5*	13.3	15.1	13.1	13.6	13.5	13.6	13.3	13.4		0.1%	
Norway	15.4	16.1	16.5	15.8	15.5	15.4	14.9	14.4	14.0	13.6		-1.4%	
United Kingdom	16.5	16.5	17.7	18.3	18.5	17.9	17.5	17.0	16.3	15.6††		-0.6%	
Czechia	16.0	16.5	15.7	16.9	17.1	17.4				16.9*		N/A	
Croatia	17.2	16.5	18.3	17.6	17.8	18.0	17.1	16.8	17.0	16.9		-0.2%	
Portugal	18.6	19.2	18.7	16.1	16.6	17.3	17.5	16.4	17.7	17.9		-0.4%	↓
EU/EEA	**18.9**	**19.1**	**19.1**	**19.6**	**19.3**	**19.7**	**19.0**	**18.5**	**18.3**	**18.0**		-0.5%	
Slovakia		21.4	17.9	21.1	18.9	22.0	21.3	18.5	20.2	18.0		-2.1%	
Malta	18.1	20.1	19.5	20.7	20.5	18.8	18.4	19.8	18.6	18.7		0.4%	
Bulgaria	15.8	17.0	16.1	17.3	18.6	18.8	17.6	18.9	19.4	19.1		2.1%	↑
Iceland	19.8*	19.8*	19.7*	19.4*	17.1	17.6	18.2	18.8	20.4	19.5		2.7%	↑
Luxembourg	23.2	23.3	23.1	23.1	21.6	21.8	21.4	20.9	20.7	19.8		-1.8%	↓
Belgium	23.1	23.6	23.9	22.6	22.4	22.8	22.5	21.1	20.7	19.8		-1.7%	↓
Italy	23.0	23.1	22.5	23.3	22.6	22.4	21.8	19.0	19.5	19.8		-1.7%	↓
Ireland	17.4	19.2	19.5	20.0	19.5	21.3	20.4	19.4	20.9	21.0		2.1%	↑
Poland	18.0	18.2	19.9	20.5	19.9	22.8	20.7	23.8	23.0	22.2		2.4%	↑
Spain	16.2†	16.6†	15.7†	16.2†	17.1†	17.5†	25.6	25.0	24.6	23.1		-3.4%	↓
France	23.2	23.4	24.0	24.1	23.1	23.8	23.9	23.0	23.6	23.3		0.1%	
Romania		26.5*	25.9*	26.8*	26.6*	28.0*	24.4*	24.5*	25.1*	24.0		N/A	
Cyprus	26.3*	26.9*	25.1*	23.9*	22.2*	26.6*	28.4*	28.9*	28.0	30.1*		1.5%	
Greece	35.6*	31.6	28.2	28.0	29.2	31.3	31.0	32.1	32.5	32.4		0.3%	↑

All country data are shown as they are reported to The European Surveillance System.
** = total care data, † = Spain reported 2010-2015 reimbursement data and changed in 2016 to sales data;* †† = The UK contributed 2019 data from England, Northern Ireland and Scotland only; N/A = not applicable.

[light shaded cells] = linear regression was not applied for the highlighted cells, because of missing data, changes in the type of data or changes of sector for which data were reported (community versus total care data).

EU/EEA refers to the corresponding population-weighted mean consumption based on reported antimicrobial consumption data of all 30 EU/EEA countries. Through imputation, proportional adjustments for countries who changed the data source during this period (Czechia, Spain) and using EU/EEA average proportions if countries had not reported separate community and hospital data for any of the years during the studied time period (e.g. for Iceland), the EU/EEA averages include the same number of EU/EEA countries for all years of the trend analyses (see the method chapter).

There were statistically significant decreases in the EU/EEA average 10-year trends for consumption of subgroups of antibacterials in the community for tetracyclines (J01A), macrolides, lincosamides, streptogramins (J01F), cephalosporins and other beta-lactams (J01D) and quinolones (J01M), while a statistically significant increase was observed for the subgroup of other antibacterials (J01X), which includes glycopeptides.

Trends in consumption of subgroups of antibacterials are available as downloadable tables D1, D2, D3, D4, D5, D6 and D7. The downloadable Tables and Figures are available on ECDC's website.

ECDC/EFSA/EMA secondary indicator for consumption of antibacterials for systemic use (ATC group J01) in the community

The ratio of consumption of broad-spectrum penicillins, cephalosporins, macrolides (except erythromycin) and fluoroquinolones (J01(CR+DC+DD+(FA–FA01)+MA)) to the consumption of narrow-spectrum penicillins, cephalosporins and erythromycin (J01(CA+CE+CF+DB+FA01)) is presented in Table 4. In 2019, the average ratio was 2.8 (country range: 0.1–20.1). During the period 2010–2019, statistically significant increasing trends were observed for the EU/EEA overall and for 10 individual countries. Statistically significant decreasing trends were observed for eight countries.

Table 4. The ratio of consumption of broad-spectrum penicillins, cephalosporins, macrolides (except erythromycin) and fluoroquinolones to the consumption of narrow-spectrum penicillins, cephalosporins and erythromycin expressed as DDD per 1 000 inhabitants per day in the community, by country, EU/EEA, 2010–2019

Country	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	Trends in antimicrobial consumption, 2010–2019	CAGR Compound annual growth rate (%)	Trend
Austria	4.2	4.1	4.4	4.4	4.4	4.4	4.2	4.2	3.9	3.6		-1.6%	
Belgium	2.3	2.4	2.4	2.0	2.2	2.2	2.2	2.2	2.1	1.9		-2.5%	↓
Bulgaria	1.7	1.9	2.1	2.3	3.0	3.5	4.2	4.0	4.2	4.5		11.1%	↑
Croatia	2.5	2.7	3.5	3.1	3.2	3.4	3.3	3.8	4.3	4.5		6.6%	↑
Cyprus	4.6*	4.8*	4.7*	5.5*	6.0*	6.7*	8.2*	8.8*	9.1*	12.5*		11.7%	↑
Czechia	2.6	2.4	2.9	2.6	2.9	3.0				3.5*		N/A	
Denmark	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3		-0.1%	
Estonia	1.9	2.1	2.2	2.5	2.5	2.7	2.8	2.9	3.0	3.0		4.9%	↑
Finland	0.5	0.5	0.5	0.4	0.4	0.4	0.4	0.4	0.3	0.3		-4.6%	↓
France	1.8	1.7	1.7	1.5	1.4	1.3	1.2	1.1	1.0	0.9		-7.2%	↓
Germany	1.9	2.1	1.9	1.9	1.9	2.0	1.9	1.8	1.7	1.5		-2.5%	↓
Greece	5.6*	5.3	4.5	4.4	7.0	4.8	3.8	4.9	4.9	5.1		-0.5%	
Hungary	5.7	5.8	6.0	6.6	9.6	11.3	10.9	11.6	12.7	13.6		10.2%	↑
Iceland	0.6*	0.7*	0.6*	0.8*	0.8	0.9	0.8	0.7	0.6	0.5		-8.6%	
Ireland	1.7	1.9	1.9	1.7	1.4	1.4	1.6	1.4	1.3	1.2		-4.3%	↓
Italy	4.9	5.4	5.6	6.1	6.6	6.9	6.9	7.1	7.5	7.5		4.8%	↑
Latvia	0.9	1.0	1.1	1.2	1.3	1.3	1.4	1.5	1.7	1.9		8.3%	↑
Lithuania	0.8*	0.8*	0.9	0.9	0.9	0.9	1.0	1.1	1.1	1.1		2.9%	↑
Luxembourg	4.2	4.3	4.5	4.4	4.4	3.9	3.6	3.7	3.5	3.2		-2.9%	↓
Malta	18.3	19.2	22.1	23.4	31.4	32.7	19.2	23.2	24.0	20.1		1.0%	
Netherlands	1.6	1.6	1.6	1.4	1.4	1.4	1.4	1.4	1.5	1.4		-1.2%	↓
Norway	0.2	0.2	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.1		-5.6%	↓
Poland	2.7	3.2	2.3	2.4	2.5	2.6	2.6	2.9	3.2	3.0		1.3%	
Portugal	5.4	5.2	5.0	5.3	5.2	5.2	5.1	4.1	4.1	5.0		-0.7%	
Romania		1.5*	1.8*	2.2*	2.2*	2.5*	3.1*	3.4*	3.9*	4.1		N/A	
Slovakia		5.1	4.9	5.3	5.6	6.6	6.5	6.6	8.0	8.3		16.6%	↑
Slovenia	1.4	1.4	1.3	1.4	1.5	1.5	1.4	1.4	1.4	1.5		0.5%	
Spain	3.3†	3.2†	3.1†	3.1†	3.0†	3.1†	2.4	2.4	2.4	2.3		-2.1%	
Sweden	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2		1.4%	
United Kingdom	0.4	0.4	0.4	0.5	0.5	0.5	0.5	0.5	0.5	0.5††		4.1%	↑
EU/EEA	**2.4**	**2.5**	**2.4**	**2.5**	**2.7**	**2.8**	**2.7**	**2.7**	**2.8**	**2.8**		1.9%	↑

All country data are shown as they are reported to The European Surveillance System.
** = total care data, † = Spain reported 2010-2015 reimbursement data and changed in 2016 to sales data;* †† = the UK contributed 2019 data from England, Northern Ireland and Scotland only; N/A = not applicable.

[light shaded cells] = linear regression was not applied for the highlighted cells, because of missing data, changes in the type of data or changes of sector for which data were reported (community versus total care data).

EU/EEA refers to the corresponding population-weighted mean consumption based on reported antimicrobial consumption data of all 30 EU/EEA countries. Through imputation, proportional adjustments for countries that changed the data source during this period (Czechia, Spain) and using EU/EEA average proportions if countries had not reported separate community and hospital data for any of the years during the studied time period (e.g. for Iceland), the EU/EEA averages include the same number of EU/EEA countries for all years of the trend analyses (see the method chapter).

The relative consumption of beta-lactamase-sensitive penicillins, combinations of penicillins including beta-lactamase inhibitors, third- and fourth-generation cephalosporins and fluoroquinolones and the ratio of broad- to narrow-spectrum antibacterials, i.e. the 'consensus-based quality indicators,' are presented in Table D8 and Figures D1, D2 and D4.

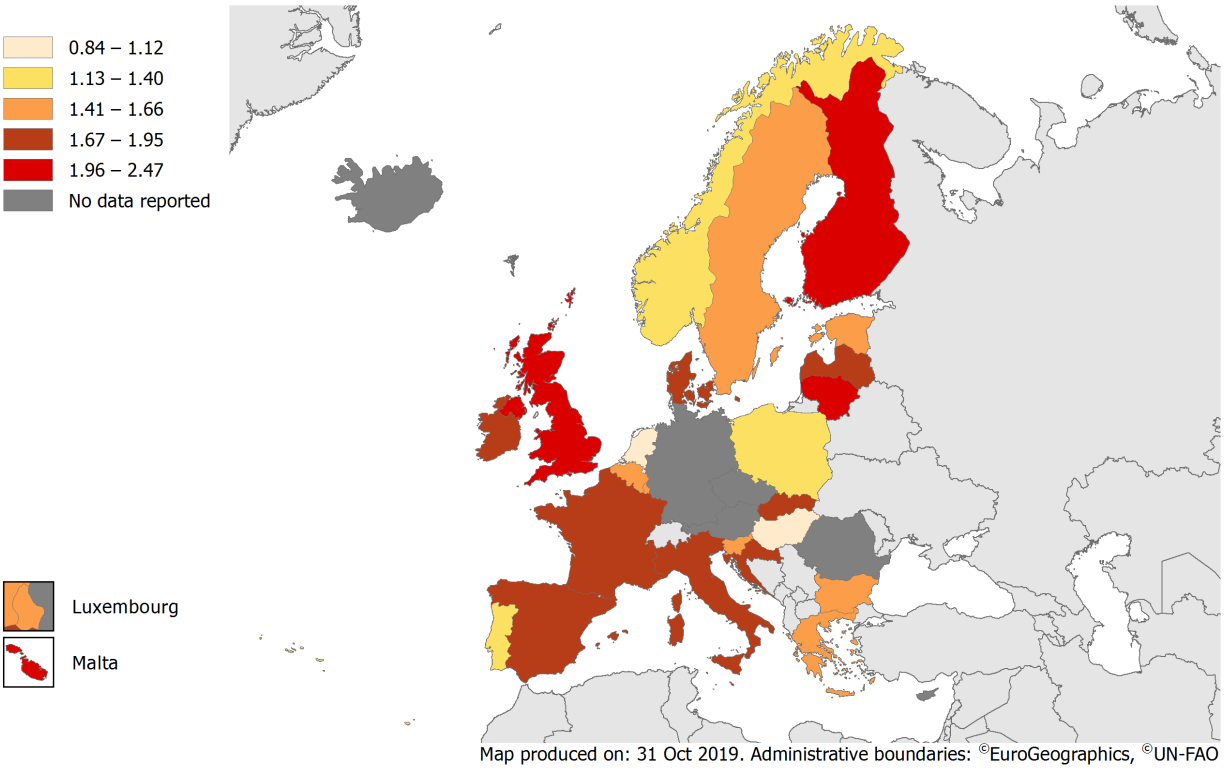
Consumption of antibacterials from other ATC groups (A07A, P01A, J04A)

Fifteen countries reported community consumption of oral vancomycin (A07AA09) and fidaxomicin (A07AA12), while consumption of rifampicin (J04AB02) and oral and rectal metronidazole (P01AB01) were reported by 27 and 29 countries, respectively (Table D9).

Consumption of antibacterials for systemic use (ATC group J01) in the hospital sector

In 2019, the EU/EEA population-weighted mean consumption of antibacterials for systemic use in the hospital sector was 1.8 DDD per 1 000 inhabitants per day, ranging from 0.8 in the Netherlands to 2.5 in the UK (Figure 3).

Figure 3. Consumption of antibacterials for systemic use (ATC group J01) in the hospital sector, EU/EEA countries, 2019 (expressed as DDD per 1 000 inhabitants per day)



Finland: data include consumption in remote primary healthcare centres and nursing homes.
Portugal: data refer to all public hospitals in the mainland and Madeira Autonomous Region. Population was adjusted, based on hospital catchment area information provided by the country.
The UK contributed 2019 data from England, Northern Ireland and Scotland only.

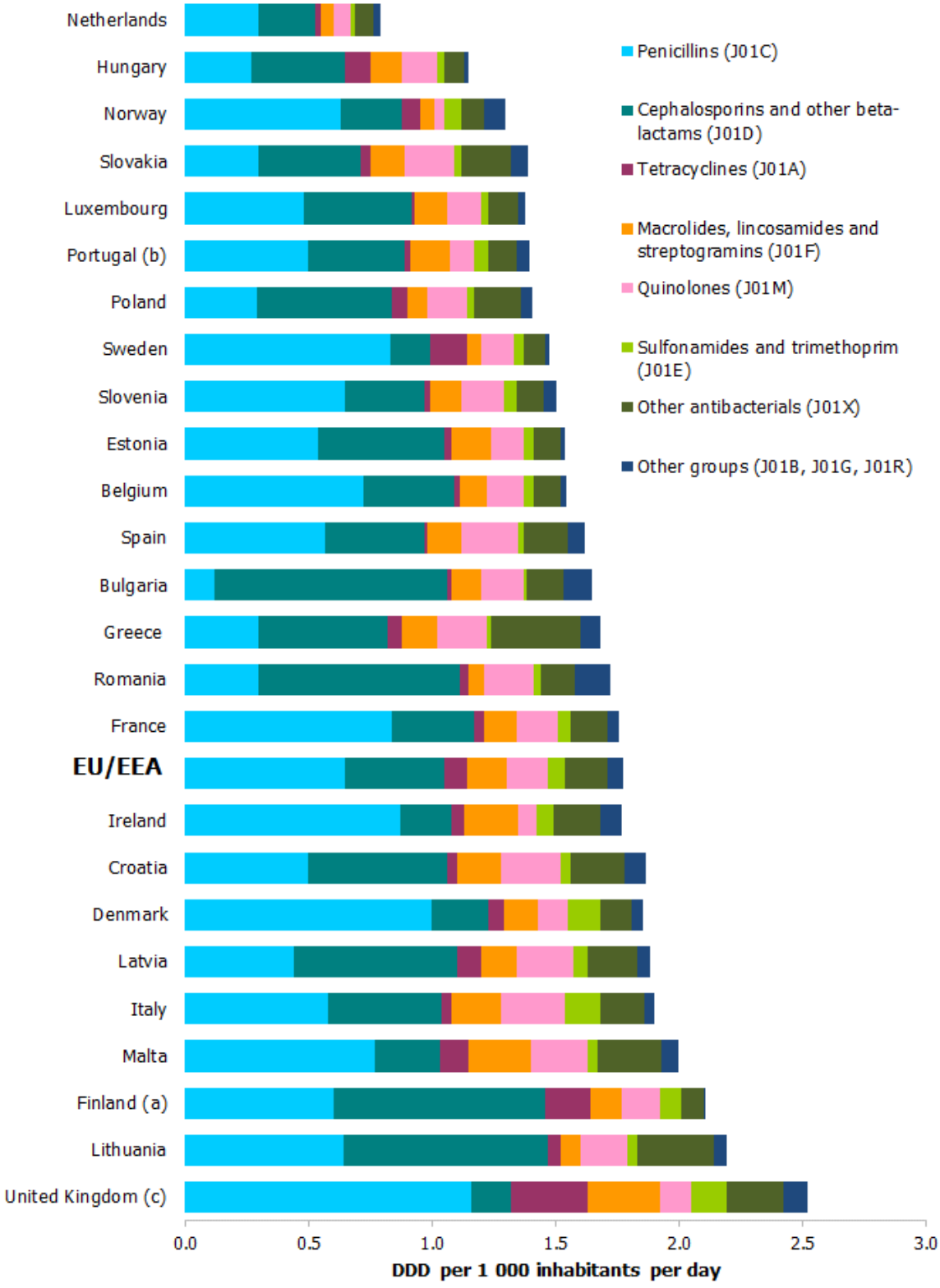
Consumption of major subgroups of antibacterials for systemic use (ATC group J01) in the hospital sector in 2019 is presented in Table 5 and Figure 4. Substantial variations were reported across countries: the proportion of consumption of penicillins (ATC group J01C) out of total consumption of antibacterials for systemic use ranged from 7% (Bulgaria) 56% (Sweden). For cephalosporins and other beta-lactams (ATC group J01D, includes carbapenems), this proportion ranged from 6% (the UK) to 58% (Bulgaria). For macrolides, lincosamides and streptogramins (ATC group J01F), it ranged from 3% (Romania) to 13% (Malta), and for quinolones (ATC group J01M) from 3% (Norway) to 14% (Slovakia).

Table 5. Consumption of antibacterials for systemic use (ATC group J01) in the hospital sector, by country and ATC group, EU/EEA, 2019 (expressed as DDD per 1 000 inhabitants per day)

Country	Tetracyclines (J01A)	Beta-lactams, penicillins (J01C)	Other beta-lactam antibacterials (J01D)	Sulfonamides and trimethoprim (J01E)	Macrolides, lincosamides and streptogramins (J01F)	Quinolones (J01M)	Other anti-bacterials (J01X)	Other groups (J01B, J01G, and J01R)*	Total (ATC group J01)
Belgium	0.02	0.72	0.37	0.04	0.11	0.15	0.11	0.02	1.54
Bulgaria	0.02	0.12	0.94	0.01	0.12	0.17	0.15	0.11	1.63
Croatia	0.04	0.50	0.56	0.04	0.18	0.24	0.22	0.09	1.85
Denmark	0.06	1.00	0.23	0.13	0.14	0.12	0.13	0.04	1.86
Estonia	0.03	0.54	0.51	0.04	0.16	0.13	0.11	0.02	1.54
Finland *(a)*	0.18	0.60	0.86	0.09	0.13	0.15	0.09	0.01	2.10
France	0.04	0.84	0.33	0.05	0.13	0.17	0.15	0.05	1.74
Greece	0.06	0.30	0.52	0.02	0.14	0.20	0.36	0.08	1.68
Hungary	0.10	0.27	0.38	0.03	0.13	0.14	0.08	0.02	1.16
Ireland	0.05	0.87	0.21	0.07	0.22	0.07	0.19	0.08	1.77
Italy	0.04	0.58	0.46	0.14	0.20	0.26	0.18	0.04	1.89
Latvia	0.10	0.44	0.66	0.06	0.14	0.23	0.20	0.05	1.88
Lithuania	0.05	0.64	0.83	0.04	0.08	0.19	0.31	0.05	2.19
Luxembourg	0.01	0.48	0.44	0.03	0.13	0.14	0.12	0.03	1.38
Malta	0.12	0.77	0.26	0.04	0.25	0.23	0.26	0.07	1.99
Netherlands	0.02	0.30	0.23	0.02	0.05	0.07	0.07	0.03	0.80
Norway	0.07	0.63	0.25	0.07	0.06	0.04	0.09	0.08	1.30
Poland	0.06	0.29	0.55	0.03	0.08	0.16	0.19	0.05	1.42
Portugal *(b)*	0.02	0.50	0.39	0.06	0.16	0.10	0.11	0.06	1.40
Romania	0.04	0.30	0.81	0.03	0.06	0.20	0.14	0.14	1.73
Slovakia	0.04	0.30	0.41	0.03	0.14	0.20	0.20	0.07	1.38
Slovenia	0.02	0.65	0.32	0.05	0.13	0.17	0.11	0.05	1.50
Spain	0.01	0.57	0.40	0.02	0.14	0.23	0.18	0.07	1.63
Sweden	0.15	0.83	0.16	0.04	0.06	0.13	0.09	0.02	1.48
UK *(c)*	0.31	1.16	0.16	0.14	0.29	0.13	0.23	0.10	2.53
EU/EEA	0.09	0.65	0.40	0.07	0.16	0.17	0.17	0.06	1.77

(a) Finland: data include consumption in remote primary healthcare centres and nursing homes.
(b) Portugal: data refer to public hospitals. Population was adjusted, based on hospital catchment area information provided by the country.
(c) The UK contributed 2019 data from England, Scotland and Northern Ireland only.
**J01B: Amphenicols; J01G: Aminoglycoside antibacterials; J01R: Combinations of antibacterials*
EU/EEA refers to the corresponding population-weighted mean consumption based on countries that provided data for 2019.

Figure 4. Consumption of antibacterials for systemic use (ATC group J01) in the hospital sector, by country and ATC group, EU/EEA, 2019 (expressed as DDD per 1 000 inhabitants per day)



(a) Finland: data include consumption in remote primary healthcare centres and nursing homes.
(b) Portugal: data refer to all public hospitals in the mainland and Madeira Autonomous Region. Population was adjusted, based on hospital catchment area information provided by the country.
(b) United Kingdom contributed 2019 data from England, Northern Ireland and Scotland only.

EU/EEA refers to the corresponding population-weighted mean consumption based on countries that provided data for 2019.

The EU/EEA population-weighted mean consumption of antibacterials for systemic use in the hospital sector expressed as DDD per 1 000 inhabitants per day did not show any statistically significant trend during the period 2010–2019 (Table 6). Statistically significant increasing trends were observed for Bulgaria, Croatia, Ireland, Lithuania, Malta, and the UK, and statistically significant decreasing trends were observed for Belgium, Finland, Latvia, Luxembourg, the Netherlands, Norway and Spain.

Table 6. Trends in consumption of antibacterials for systemic use (ATC group J01) in the hospital sector, by country, EU/EEA, 2010–2019 (expressed as DDD per 1 000 inhabitants per day)

Country	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	Trends in antimicrobial consumption, 2010–2019	CAGR Compound annual growth rate (%)	Trend
Netherlands	0.93	0.85	0.85	0.84	0.85	0.87	0.85	0.83	0.84	0.80		-1.7%	↓
Hungary	1.21	1.08	1.11	1.08	1.13	1.11	1.07	1.13	1.12	1.16		-0.5%	
Norway	1.40	1.43	1.40	1.35	1.36	1.36	1.34	1.38	1.30	1.30		-0.8%	↓
Slovakia			1.85	2.03	2.30	2.22	2.31	1.45	1.81	1.38		-4.2%	
Luxembourg	1.90	1.84	1.83	1.82	1.64	1.61	1.57	1.62	1.40	1.38		-3.4%	↓
Portugal	1.31	1.35	1.35	1.51	1.43	1.45	1.46	1.44	1.40	1.40		0.7%	↑
Poland					1.32	1.31	1.25	1.62	1.36	1.42		1.5%	
Sweden	1.45	1.53	1.57	1.60	1.49	1.59	1.56	1.51	1.65	1.48		0.3%	
Slovenia	1.54	1.48	1.39	1.38	1.43	1.49	1.50	1.52	1.50	1.50		-0.3%	
Estonia	1.63	1.64	1.88	1.69	1.71	1.62	1.58	1.65	1.56	1.54		-0.6%	
Belgium	1.76	1.76	1.70	1.64	1.62	1.64	1.64	1.62	1.62	1.54		-1.5%	↓
Spain							1.83	1.75	1.73	1.63		-3.7%	↓
Bulgaria	1.33	1.37	1.33	1.34	1.35	1.32	1.58	1.52	1.62	1.64		2.4%	↑
Greece		1.78	1.66	1.79	1.87	1.91	2.15	2.07	1.66	1.68		-0.7%	
Romania										1.73		N/A	
France	1.82	1.74	1.73	1.76	1.79	1.77	1.76	1.73	1.77	1.74		-0.5%	
EU/EEA	**1.77**	**1.73**	**1.73**	**1.70**	**1.75**	**1.78**	**1.82**	**1.78**	**1.79**	**1.77**		<0.1%	
Ireland	1.60	1.61	1.58	1.59	1.48	1.71	1.66	1.60	1.79	1.77		1.1%	↑
Croatia	1.59	1.69	1.75	1.58	1.65	1.70	1.65	1.74	1.80	1.85		1.7%	↑
Denmark	1.63	1.61	1.65	1.88	1.97	2.19	1.84	1.91	1.94	1.86		1.5%	
Latvia	2.65	2.08	1.98	1.96	1.94	1.94	1.83	1.89	1.89	1.88		-3.7%	↓
Italy	1.87	2.00	2.13	1.87	1.86	2.09	2.21	1.89	1.91	1.89		0.1%	
Malta	1.80	1.53	1.31	1.56	1.95	2.49	2.52	2.78	2.24	1.99		1.1%	↑
Finland	2.71	2.96	2.65	2.63	2.51	2.36	2.38	2.11	2.28	2.10		-2.8%	↓
Lithuania			2.06	1.98	1.96	2.15	2.12	2.12	2.12	2.19		0.9%	
United Kingdom				2.07	2.23	2.19	2.27	2.30	2.47	2.5††		3.3%	↑

All country data are shown as they are reported to The European Surveillance System.

(a) Finland: data include consumption in remote primary healthcare centres and nursing homes.
(b) Portugal: data refer to public hospitals. Population was adjusted, based on hospital catchment area information provided by the country.
†† = The UK contributed 2019 data from England, Northern Ireland and Scotland only;
N/A = not applicable.

[light shaded cells] = linear regression was not applied for the highlighted cells and years with missing data.

EU/EEA refers to the corresponding population-weighted mean consumption based on reported antimicrobial consumption data of all 30 EU/EEA countries. Through imputation and proportional adjustments for countries who changed the data source during this period (Spain), the EU/EEA averages include the same number of EU/EEA countries for all years of the trend analyses (Please see the method chapter, page 4).

Consumption of specific antimicrobial groups used for the treatment of patients infected with healthcare-associated resistant bacteria in the hospital sector

The EU/EEA population-weighted mean consumption of piperacillin-tazobactam (ATC J01CR05) showed a statistically significant increasing trend for the period 2010–2019, as was the case in two-thirds of the countries reporting hospital sector data.

In 2019, consumption of carbapenems (ATC group J01DH) was 0.04 DDD per 1 000 inhabitants per day (Table D10). Between 2010 and 2019, the EU/EEA population-weighted mean consumption of carbapenems did not show a statistically significant change (Table D10). A statistically significant increase was observed for 11 countries (Bulgaria, Croatia, Denmark, Estonia, Greece, Hungary, Lithuania, Malta, the Netherlands, Poland, Slovakia). During the period 2010–2019, only Norway and Portugal showed a statistically significant decreasing trend.

The EU/EEA population-weighted mean consumption of polymyxins (ATC group J01XB) showed a statistically significant increase during 2010 and 2019 (Table D11). A statistically significant increase was observed for 10 countries (Bulgaria, Denmark, Hungary, Greece, Italy, Latvia, Norway, Slovakia, Spain, the UK). During 2010–2019, only Ireland and the Netherlands showed a statistically significant decreasing trend.

The EU/EEA population-weighted mean consumption of antimicrobials for the treatment of infections caused by multidrug-resistant gram-positive bacteria such as linezolid, daptomycin and tigecycline showed a statistically significant increasing trend for the period 2010-2019. A statistically significant decrease in consumption of these antimicrobials was observed for more than half of the countries that continuously reported antimicrobial consumption data from the hospital sector between 2010 and 2019.

New antibacterial agents (e.g. combinations of cephalosporins and beta-lactamase inhibitors) have recently been authorised for use in the EU. Consumption of such antibacterial agents (ceftazidime-avibactam, ATC J01DD52 and ceftolozane-tazobactam, ATC J01DI54), was still low in 2019, with 22 and 18 EU/EEA countries reporting consumption, respectively.

ECDC/EFSA/EMA secondary indicator for consumption of antibacterials for systemic use (ATC group J01) in the hospital sector

The proportion of glycopeptides, third- and fourth-generation cephalosporins, monobactams, carbapenems, fluoroquinolones, polymyxins, piperacillin and enzyme inhibitor, linezolid, tedizolid and daptomycin out of the total hospital consumption of antibacterials for systemic use is presented in Table 7.

The average proportion was 33.7% and ranged from 16.6% in the UK to 58.5% in Bulgaria. During the period 2010–2019, statistically significant increasing trends were observed for the EU/EEA overall and for seven countries, whereas only one country showed a statistically significant decreasing trend (Table 7).

Table 7. The proportion of glycopeptides, third- and fourth-generation cephalosporins, monobactams, carbapenems, fluoroquinolones, polymyxins, piperacillin and enzyme inhibitor, linezolid, tedizolid and daptomycin (DDD per 1 000 inhabitants per day) out of total hospital consumption of antibacterials for systemic use, by country, EU/EEA, 2010–2019

Country	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	Trends in antimicrobial consumption, 2010–2019	CAGR Compound annual growth rate (%)	Trend
Belgium	28.9	30.2	31.1	31.3	31.5	31.7	31.0	30.9	30.1	28.8		-0.1%	
Bulgaria	45.2	51.0	55.2	52.7	57.5	55.2	59.8	58.1	57.5	58.5		2.9%	↑
Croatia	29.9	26.2	26.5	27.8	31.0	31.7	30.9	32.2	32.2	33.5		1.3%	↑
Denmark	20.1	20.7	21.3	22.7	22.6	20.6	23.7	21.4	22.9	23.9		1.9%	↑
Estonia	17.9	20.0	23.2	19.3	20.0	20.0	20.6	23.2	19.8	21.8		2.2%	
Finland	19.3	18.9	19.0	22.2	22.7	21.9	22.9	23.2	19.4	18.1		-0.7%	
France	32.2	30.0	32.0	31.3	32.3	32.2	31.3	31.6	32.6	30.1		-0.8%	
Greece		38.2	39.5	35.9	35.7	38.6	35.8	36.8	49.1	50.8		3.6%	
Hungary	36.1	37.4	37.2	37.8	37.4	38.8	39.4	40.1	40.6	36.2		0.0%	
Ireland	25.8	25.9	26.3	32.3	36.9	29.5	30.1	29.4	28.7	28.1		1.0%	
Italy	47.2	42.7	44.2	49.1	48.4	42.8	37.0	48.6	48.5	44.5		-0.7%	
Latvia	37.8	33.3	37.2	40.3	40.0	38.9	40.5	38.4	38.7	40.6		0.8%	
Lithuania			26.8	19.6	20.4	25.2	24.9	24.6	22.5	24.5		-1.3%	
Luxembourg	30.0	29.7	31.3	31.1	31.8	33.3	36.0	34.0	35.7	35.1		1.8%	↑
Malta	23.3	27.2	29.3	30.2	34.8	33.4	27.5	27.4	37.9	37.0		5.3%	↑
Netherlands	23.1	24.2	24.8	25.2	25.2	25.1	25.2	24.6	25.1	24.4		0.6%	
Norway	20.8	21.1	21.5	21.8	22.1	22.1	22.3	19.8	20.7	19.4		-0.8%	
Poland					23.5	24.1	34.2	24.3	31.8	29.2		4.4%	
Portugal	39.9	40.0	41.0	42.6	43.8	43.6	43.5	42.2	42.8	42.6		0.7%	↑
Romania										55.4		N/A	
Slovakia			27.1	27.4	28.0	30.5	30.8	35.1	32.6	32.3		2.6%	↑
Slovenia	32.0	33.2	32.4	31.5	32.1	32.8	32.1	31.2	31.4	30.7		-0.5%	↓
Spain							47.8	45.3	44.6	45.7		-1.5%	
Sweden	25.0	24.7	25.0	25.2	27.1	26.5	27.4	26.9	24.6	28.3		1.4%	
United Kingdom				15.9	16.8	17.4	17.6	16.6	16.7	16.6††		0.8%	
EU/EEA	**30.6**	**30.2**	**30.8**	**31.3**	**31.7**	**31.2**	**31.7**	**33.8**	**34.8**	**33.7**		**1.1%**	↑

All country data are shown as they are reported to The European Surveillance System.
(a) Finland: data include consumption in remote primary healthcare centres and nursing homes.
(b) Portugal: data refer to public hospitals. Population was adjusted, based on hospital catchment area information provided by the country.
†† = The UK contributed 2019 data from only England, Northern Ireland and Scotland;
N/A = not applicable.

[light shaded cells] = linear regression was not applied for the highlighted cells and years with missing data.

EU/EEA refers to the corresponding population-weighted mean consumption based on reported antimicrobial consumption data of all 30 EU/EEA countries. Through imputation and proportional adjustments for countries who changed the data source during this period (Spain), the EU/EEA averages include the same number of EU/EEA countries for all years of the trend analyses (see the method chapter).

Consumption of antibacterials from other ATC groups (A07A, P01A, J04A)

In 2019, hospital consumption of oral vancomycin (ATC A07AA09) and fidaxomicin (ATC A07AA12) was reported from 18 countries and ranged from 1×10^{-4} DDD per 1 000 inhabitants per day in Hungary to a maximum of 0.01 DDD per 1 000 inhabitants per day in Denmark.

Oral and rectal metronidazole (ATC P01AB01) consumption in the hospital sector was reported by 23 countries, ranging from 5×10^{-4} DDD per 1 000 inhabitants per day in Bulgaria to 0.13 DDD per 1 000 inhabitants per day in Malta.

Rifampicin (ATC J04AB02) consumption was reported by 21 countries and ranged from a minimum of 0.006 DDD per 1 000 inhabitants per day in Poland to a maximum of 0.15 DDD per 1 000 inhabitants per day in Romania.

Consumption of oral vancomycin (A07AA09), rifampicin (J04AB02), and oral and rectal metronidazole (P01AB01) is presented in Table D12.

Consumption of antimycotics and antifungals for systemic use (ATC groups J02 & D01B) in the community

In 2019, 27 countries reported data on consumption of antimycotics and antifungals for systemic use (ATC groups J02 & D01B) in the community (Table D13 and Figure D5).

The EU/EEA population-weighted mean consumption was 1.0 DDD per 1 000 inhabitants per day and consumption varied by a factor of 7, ranging from 0.42 (Croatia) to 3.0 DDD per 1 000 inhabitants per day (Cyprus, reporting total care data).

In 2019, terbinafine (D01B02), fluconazole (J02AC01), and itraconazole (J02AC02) comprised between 90% and 100% of the total consumption of antimycotics and antifungals for systemic use in the community among the reporting countries.

Consumption of antimycotics and antifungals for systemic use (ATC groups J02 & D01B) in the hospital sector

In 2019, 21 countries reported data on consumption of antimycotics and antifungals for systemic use (ATC groups J02 & D01B) in the hospital sector (Table D14, Figure D8).

The EU/EEA population-weighted mean consumption was 0.12 DDD per 1 000 inhabitants per day. Consumption varied by a factor of seven, from 0.03 (Bulgaria) to 0.21 DDD per 1 000 inhabitants per day (France).

In 2019, fluconazole (J02AC01) accounted for 38% of the total consumption of antimycotics and antifungals for systemic use in the hospital sector among the reporting countries and from 18% (France) to 94% (Bulgaria).

Consumption of antivirals for systemic use (ATC group J05) in both sectors (community and hospital sector combined)

In 2019, 28 countries reported data on antivirals for systemic use (ATC group J05). The data were pooled for the two sectors (Table D15 and D16). Austria, Germany, Iceland, the Netherlands and Spain only reported data for the community.

The total EU/EEA population-weighted mean consumption of antivirals for systemic use (ATC group J05 was 2.34 DDD per 1 000 inhabitants per day and did not show any statistically significant trend during a five-year period 2015–2019 (Table D17).

Consumption of antivirals for systemic use showed a 27-fold difference between countries, from 0.25 DDD per 1 000 inhabitants per day in Spain to 6.75 in Estonia. Statistically significant increasing trends were observed for 16 countries (Austria, Belgium, Bulgaria, Cyprus, Denmark, Estonia, Finland, Germany, Hungary, Latvia, Lithuania, Luxembourg, the Netherlands, Norway, Portugal and Sweden). Italy showed a significantly decreasing trend.

The EU/EEA population-weighted mean consumption in the reporting countries was the highest for combinations of antivirals to treat HIV infections (ATC group J05AR) (0.86 DDD per 1 000 inhabitants per day).

Table D17 and Figure D7 show the distribution of total consumption of antivirals for systemic use (ATC group J05) by their main indication: 'HIV/AIDS antivirals' 'HIV/hepatitis B antivirals', 'hepatitis B antivirals', 'hepatitis C antivirals', 'herpes antivirals', 'influenza antivirals' and one group for remaining substances. The EU/EEA population-weighted mean consumption of HIV/AIDS antivirals accounted for 54% of the total consumption of antivirals for systemic use (ATC group J05) in the reporting countries. The proportion of HIV/AIDS antivirals out of total consumption of antivirals for systemic use (ATC group J05) ranged from 1.5% in Poland to 87% in Estonia.

Malta reported the highest proportion of HIV/hepatitis B antivirals (51%), and Slovenia reported the highest proportion of hepatitis B antivirals (27%).

The proportion of hepatitis C antivirals (new ATC group J05AP) out of the total consumption of antivirals for systemic use (ATC group J05) ranged from 0.0% (Malta and Iceland) to 16% (Lithuania). In 2019, direct-acting antivirals (DAA) were under surveillance within this group and 26 countries reported consumption of at least one DAA.

For herpes antivirals, the proportion of total consumption of antivirals for systemic use (ATC group J05) ranged from <0.01 % (Italy) to 45% (Slovenia). Spain only reported consumption for herpes antivirals.

In 2019, the EU/EEA population-weighted mean consumption of substances used to treat influenza (rimantadine, J05AC02; zanamivir, J05AH01; oseltamivir, J05AH02) was 0.05 DDD per 1 000 inhabitants per day and ranged from <0.01 DDD per 1 000 inhabitants per day in Belgium, Germany, Hungary, Italy, Luxembourg, the Netherlands, and Slovakia to 0.44 DDD per 1 000 inhabitants per day in Latvia and Lithuania, accounting for 13% and 25% of the total consumption of antivirals for systemic use in these two countries, respectively.

Discussion

For the past two decades, efforts have been made worldwide to optimise antimicrobial use as a means of addressing increasing antimicrobial resistance (AMR). AMR is considered one of the biggest threats to public health in the EU/EEA [11], with high levels of AMR reported for several important bacterial species [12] and resulting in an estimated 33 000 deaths attributable to infections with antibiotic-resistant bacteria each year [13].

Antimicrobial use is one of the major drivers behind the occurrence and spread of AMR. Positive associations between national resistance percentages reported to the European Antimicrobial Resistance Surveillance Network (EARS-Net) and national antimicrobial consumption rates reported to ESAC-Net [14] emphasise the need to promote the responsible use of antibiotics to address AMR. Controlling the increase of AMR, both in the community and in the hospital sector, is the main aim of antimicrobial stewardship programmes (ASPs). Antimicrobial consumption and AMR surveillance are central to evaluating the effectiveness of ASPs and identifying targets for interventions.

In June 2017, the European Commission adopted a European One Health Action Plan against antimicrobial resistance [11]. The aim of this action plan is to support the EU and its Member States in delivering innovative, effective and sustainable responses to AMR. One of the key objectives of the action plan is to promote the prudent use of antimicrobials, which includes methods for data-gathering and reporting on the sales and use of antimicrobials. The Action Plan notes that success should be measured through a limited number of key outcome indicators, based on data already collected.

To support EU Member States in their efforts to address AMR, the European Commission requested that ECDC, EFSA and EMA establish a list of harmonised outcome indicators for antimicrobial consumption and AMR. The chosen indicators had to take into account the 'One Health' approach and be suitable for evaluating progress made in reducing bacterial resistance to key antimicrobials in humans and animals. They also had to allow for evaluating improvements in the appropriateness and need for the use of antimicrobials in the EU. The indicators should be reconsidered at least every five years to determine whether they still reflect available data [7]. The primary antimicrobial consumption indicator, i.e. total consumption expressed as 'DDD per 1 000 inhabitants per day', as well as the two secondary outcome indicators have been used in this as in previous ESAC-Net reports.

To better illustrate the meaning of the indicator 'DDD per 1 000 inhabitants per day', the indicator 'number of DDD per person (inhabitant) per year' may be used. An estimate of the number of days annually for which, on average, each person is treated with an antibiotic can easily be calculated from the indicator 'DDD per 1 000 inhabitants per day' by dividing the figure by 1 000 (population) and multiplying it by 365 (days in a year) or, shortened, by multiplying the figure by 0.365. In 2019 in the EU/EEA, there were about seven DDD of antibacterials for systemic use per person in the community (i.e. outside of the hospital sector). In other words, on average in 2019, each person in the EU/EAA received an antibiotic for approximately seven days, which in most cases corresponds to one antibiotic course.

The results presented in this report should be interpreted with caution and used at the national level rather than for international benchmarking purposes. They may serve to evaluate antimicrobial stewardship interventions on the national level, but may also reflect the burden of infections caused by multidrug-resistant microorganisms in each country.

Between 2010 and 2019, the average total (community and hospital sector combined) consumption of antibacterials for systemic use (ATC group J01) showed a statistically significant decreasing trend for the EU/EEA overall for the first time. However, this trend was not observed when the community and the hospital sector were considered separately.

A time series analysis based on EARS-Net and ESAC-Net data analysing trends in the community and hospital sector consumption of fluoroquinolones, third-generation cephalosporins and carbapenems and antimicrobial resistance in *Escherichia coli* and *Klebsiella pneumoniae* between 2001 and 2018 in the EU/EEA showed stabilising or decreasing trends in antimicrobial consumption and stabilising or slowing down trends in resistance. It suggested an early signal of the positive effects of antimicrobial stewardship initiatives in EU/EEA countries [15]. In 2019, consumption of antibacterials for systemic use (ATC group J01) in the community varied greatly between EU/EEA countries and showed a more than three-fold difference between the lowest and the highest consuming country. There are many reasons for these large differences, some of which are cultural determinants rather than a reflection of disease prevalence.

The EU/EEA population-weighted mean consumption of antibacterials for systemic use (ATC group J01) in the community did not show any statistically significant change during the period 2010–2019. At the national level, and in contrast to previous years, the trends appear to more divergent; i.e. more countries showed a statistically significant increasing or decreasing trend in the consumption of antibacterials for systemic use (i.e. 18 countries in this report compared to 13 countries in the last report of 2018).

In addition, a statistically significant increasing trend of EU/EEA population-weighted mean consumption was only reported for ATC group J01X (this group includes glycopeptides) and statistically decreasing trends were observed for three subgroups tetracyclines (ATC J01A), macrolides, lincosamines and streptogramins (ATC J01F), cephalosporins and other beta-lactams (J01D) and for quinolones (ATC J01M). For quinolones, 18 countries, i.e. more than half of the countries that continuously reported data between 2010 and 2019, reported a statistically significant decreasing trend in the community consumption. These 10-year trends (2010–2019) in the consumption of antibacterials for systemic use in the community may reflect antimicrobial stewardship activities in EU/EEA countries, including awareness campaigns connected to the European Antibiotic Awareness Day after its introduction in 2008.

Any ranking of the countries based on the 'consensus-based quality indicators' should be interpreted with caution, as the indicators are not independent. For example, an increase in the consumption of macrolides, lincosamides and streptogramins (ATC J01F) will probably result in an increase in the ratio of broad-spectrum penicillins, cephalosporins and macrolides to narrow-spectrum penicillins, cephalosporins and erythromycin. For countries for which changes in the ranking suggest quality improvement, this may reflect a relative change compared with other countries. For example, quality may have decreased in all countries but less so in the specific country in question [16]. It should be emphasised that these indicators cannot by themselves indicate quality of antimicrobial use in the community, unless they are combined with corresponding clinical data (e.g. indications, antimicrobial resistance patterns, current national programmes such as guidelines, restrictions).

In the hospital sector, the proportions of cephalosporins, other beta-lactams (including carbapenems) and other groups of antimicrobials were generally higher than in the community. However, the appropriateness of antimicrobial consumption cannot be judged based on only consumption data and should be assessed at a national level taking into account national policies, guidelines and AMR levels.

Penicillins combined with beta-lactamase inhibitors (e.g. piperacillin-tazobactam) represent a group of antibiotics available for the treatment of infections caused by extended-spectrum beta-lactamase (ESBL)-producing gram-negative bacteria. However, they are ineffective against carbapenem-resistant gram-negative bacteria. Carbapenems are a last-line group of antimicrobials and are mainly used in hospitals to treat patients with confirmed or suspected serious infections involving multidrug-resistant gram-negative bacteria. Previous use of carbapenems is a risk factor for subsequent infection with carbapenem-resistant bacteria such as carbapenem-resistant Enterobacterales (CRE), carbapenem-resistant *Acinetobacter baumannii* or carbapenem-resistant *Pseudomonas aeruginosa*. The second Joint Interagency Antimicrobial Consumption and Resistance Analysis (JIACRA) report from ECDC, EFSA and EMA showed a strong association between carbapenem consumption and the percentage of carbapenem resistance in *Klebsiella pneumoniae* invasive isolates (mainly from bloodstream infections) in EU/EEA countries reporting these data [14]. Carbapenem-resistant bacteria are highly drug-resistant and only a few antibiotic groups, such as polymyxins (mainly colistin) as well as new combinations of beta-lactams with beta-lactamase inhibitors, are available for the treatment of patients infected with such bacteria [17,18].

The impact of shortages of antimicrobials on consumption of antibacterials for systemic use in EU/EEA countries is unknown, but certainly represents a challenge to antimicrobial stewardship teams responsible for providing guidance on alternative treatments. For instance, the global shortage of piperacillin-tazobactam in 2016 and 2017 could have caused a shift towards increased consumption of third- and fourth-generation cephalosporins and of carbapenems. Such changes were not observed for the EU/EEA population-weighted mean consumption of these groups, but would need to be assessed at national level in each country.

For carbapenem consumption, one third of the countries having reported data continuously between 2010 and 2019 reported a statistically significant increasing trend, but these increases did not affect the trend of the EU/EEA population-weighted mean consumption of carbapenems over the past 10 years. Assuming that the average duration of one carbapenem treatment is 10 days, the consumption of 0.04 DDD per 1 000 inhabitants per day corresponds to around 800 000 carbapenem treatment courses administered in the EU/EEA each year.

For the consumption of certain antimicrobials (e.g. linezolid, daptomycin and tigecycline for the treatment of infections caused by multidrug-resistant gram-positive bacteria), the occurrence of statistically significant increasing 10-year-trends of the EU/EEA population-weighted mean is consistent with data from EARS-Net, which showed an increasing EU/EEA population-weighted mean percentage of vancomycin resistance in *Enterococcus faecium* invasive isolates (mainly from bloodstream infections) – from 10.5% in 2015 to 18.3% in 2019 –, as well as corresponding increasing trends in almost half of the countries [12].

The EU/EEA population-weighted mean decreased in both sectors during 2010-2019, although some countries still show an increasing trend in the consumption of this group. On 11 March 2019, the European Commission issued a legally binding decision regarding the use of fluoroquinolones based on EMA's recommendation, i.e. the marketing authorisation of medicines containing cinoxacin, flumequine, nalidixic acid, and pipemidic acid is suspended, and the use of the remaining fluoroquinolones should be restricted because of the risk of disabling and potentially permanent side-effects. According to EMA's recommendation, fluoroquinolones should not be used (a) t*o treat infections that might get better without treatment or infections which are not severe (such as throat infections); (b) to treat non-bacterial infections, e.g. non-bacterial (chronic) prostatitis; (c) for preventing traveller's diarrhoea*

or recurring lower urinary tract infections (urine infections that do not extend beyond the bladder); (d) to treat mild or moderate bacterial infections unless other antibacterial medicines commonly recommended for these infections cannot be used. National authorities will enforce this decision for the fluoroquinolone and quinolone medicines authorised in their countries and they will also take other appropriate measures to promote the correct use of these antibiotics [1].

As expected, the consumption pattern of antimycotics and antifungals for systemic use in the hospital sector differed from that in the community due to different aetiology and variations in the diseases and disease severity treated in the sectors. In the hospital sector, the antimycotic with the highest consumption was fluconazole, as opposed to terbinafine in the community.

Within the ATC groups of antimicrobials for systemic use (ATC groups J01, J02 & D01B, and J05), antivirals for systemic use (ATC group J05) showed the highest variation among countries. A five-year trend analysis did not show a significant trend at EU/EEA level, but statistically increasing trends were reported by more than half of the countries. An increasing number of countries are reporting consumption of direct acting antivirals for the treatment of HCV infection. As shown with antibacterials for systemic use (ATC group J01), further analyses may highlight certain socioeconomic or structural determinants that would explain such variation. Countries are encouraged to report data on the consumption of antivirals for systemic use to The European Surveillance System.

In 2019, the DDDs for nine antimicrobials and routes of administration were set to higher values by the WHO Collaborating Centre for Drug Statistics Methodology. Consequently, the consumption of respective antimicrobial groups as well as total antimicrobial consumption may appear to be lower than in previously published ECDC reports on antimicrobial consumption. The largest impact of this change was seen for penicillins and ranking of countries in the EU/EEA benchmark. To avoid misinterpretation of antimicrobial consumption data, readers should always consult the latest annual epidemiological report or the ESAC-Net Interactive database where 10-year trends in antimicrobial consumption are displayed taking into account the latest DDD update.

Finally, the ongoing COVID-19 pandemic could, in principle, have impacted the quality and timeliness of reporting antimicrobial consumption data. However, the results presented in this report show that, despite difficult circumstances, efforts have been made by ESAC-Net members to report 2019 data and make this publication possible. The impact of the ongoing COVID-19 pandemic on antimicrobial consumption in the EU/EEA will only be assessed when 2020 data are available. The fear of the overuse of antibiotics due to the COVID-19 pandemic may be overestimated [21]. The reports published by some countries that assess the impact of the COVID-19 pandemic and lockdowns show a reduction in overall antibiotic consumption in the community, suggesting that lockdowns not only led to the controlling of transmission of SARS-CoV-2, but also a decrease in inappropriate prescribing due to the reduction of ambulatory visits for mild upper respiratory tract infections, mostly viral in origin. In Italy, antimicrobial consumption in the community during March-May 2020 fell by 22%-53% from that in the same period in 2019 [22]. Similarly, a Swedish report on the number of prescriptions per 1 000 inhabitants for the second quarter of 2020 show a reduction of 29% compared to the previous year, especially in children younger than seven years old (65%) [23]. In Portugal, antimicrobial consumption in the community during January-August 2020 fell by 21% compared to the same period in 2019 [24]. Nevertheless, even in the midst of the COVID-19 pandemic, ASP principles should be continuously applied and promoted. The European Study Group on Antimicrobial Stewardship has endorsed a set of recommendations on the use of antimicrobials in patients with suspected or confirmed COVID-19 infection [25].

Limitations

The quality of antimicrobial consumption data depends on the type of data available for a given sector. For ESAC-Net, countries provide sales and/or reimbursement data, and each data source has its advantages and limitations. The major limitation of reimbursement data is that antimicrobials dispensed without a prescription and non-reimbursed prescribed antimicrobials are not included [26]. For this reason, countries that report reimbursement data and are known to have a substantial proportion of antimicrobials dispensed without a prescription have been indicated in the tables and figures in this report. In addition, the source of data in individual countries may change from one year to another, possibly affecting the patterns of and trends in antimicrobial consumption.

In addition, the types of healthcare facilities included in the hospital sector differ across EU/EEA countries. For example, hospital data from Finland include consumption from nursing homes and remote primary healthcare centres. In the UK, patients have shorter lengths of hospital stay on average than in other countries and, when antimicrobials are prescribed, there is a policy of dispensing, via the hospital pharmacy, a full course of antimicrobials to patients discharged from the hospital. Consequently, in both countries hospital consumption is relatively higher and community consumption relatively lower than in other countries.

[1] https://www.ema.europa.eu/en/medicines/human/referrals/quinolone-fluoroquinolone-containing-medicinal-products

Public health conclusions

Reducing the unnecessary and inappropriate use of antimicrobials is a public health priority. Antimicrobial stewardship programmes (ASPs) aim to improve antimicrobial use in order to prevent the emergence of AMR and improve patient outcomes. Antimicrobial consumption and AMR surveillance are central to evaluating the effectiveness of ASPs and identifying targets for interventions. As antimicrobial consumption patterns and trends differ across countries, so do the extent, pattern and trends of AMR. Thus, reliable antimicrobial consumption data from each EU/EEA country are necessary to better understand the epidemiology of AMR in the EU/EEA.

In the community, the decreasing trends in antimicrobial consumption, overall or of frequently used antimicrobial groups, observed in several EU/EEA countries, may be the result of national initiatives, e.g. awareness campaigns, promoting prudent use of antimicrobials, during the past years.

In the hospital sector, there was no statistically significant trend at the EU/EEA level in the consumption of last-line groups of antimicrobials such as carbapenems, and several EU/EEA countries even showed a statistically significant increasing trend in the consumption of last-line groups of antimicrobials. This observation suggests that the current efforts to implement ASPs may need to be intensified in some countries. Unnecessary antibiotic use in hospitals promotes the emergence and spread of multidrug-resistant bacteria responsible for healthcare-associated infections. In particular, the use of broad-spectrum antimicrobials creates the greatest selective pressure for the development of multi-drug resistance, especially in gram-negative bacteria.

To combat increasing AMR within a 'One-Health' approach, EU/EEA countries agreed to develop their own national action plans, including antimicrobial stewardship strategies based on national surveillance of antimicrobial consumption and AMR [27].

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Annex