

Summary of the latest data on antibiotic consumption in the European Union

ESAC-Net surveillance data
November 2015

- Provision of reliable national antimicrobial consumption data is a prerequisite for our understanding of antibiotic resistance epidemiology in Europe, since antibiotic use is one of the main factors responsible for antibiotic resistance.
- Although the vast majority of antibiotics are consumed in the community (outside hospitals), antibiotic use in hospitals is a major driver of the spread of multidrug-resistant bacteria responsible for healthcare-associated infections.
- During 2010–2014, overall antibiotic consumption in the community within the European Union (EU) (expressed in defined daily doses (DDD) per 1 000 inhabitants and per day) showed a significant increasing trend and the large inter-country variation in antibiotic consumption remained. When expressing antibiotic consumption in terms of number of packages (as a better surrogate for prescriptions) per 1 000 inhabitants and per day, several countries showed a significant decrease over time during the period 2010–2014.
- During 2010–2014, overall antibiotic consumption in the EU hospital sector (expressed in defined daily doses (DDD) per 1 000 inhabitants and per day) showed a significant increasing trend. A significant increase in the consumption of specific antibiotic groups was also observed during this period at EU level and in several countries (e.g. antibiotics used for treatment of patients infected with multidrug-resistant bacteria).

Recent national antibiotic consumption data for the community and the hospital sector are publicly available from the [European Surveillance of Antimicrobial Consumption Network](#) (ESAC-Net). These data at the EU and national level are specifically provided for healthcare professionals, to help evaluate the effectiveness of awareness campaigns on the prudent use of antibiotics, or to identify issues that can be addressed by national antimicrobial stewardship programmes.

Antibiotic consumption in the community (outside hospitals)

In 2014, consumption of antibiotics for systemic use ranged from 10.6 DDD per 1 000 inhabitants and per day (the Netherlands) to 34.1 DDD per 1 000 inhabitants and per day (Greece); a 3.2-fold difference, which is similar to that seen in previous years. The population-weighted EU/EEA mean consumption was 21.6 DDD per 1 000 inhabitants and per day, showing an overall significant increasing trend. The United Kingdom showed a significant increasing trend, while Cyprus and Sweden showed a significant decreasing trend for the period 2010–2014.

Using another indicator (i.e. packages per 1 000 inhabitants and per day), consumption of antibiotics in 2014 ranged from 1.0 package per 1 000 inhabitants and per day (Sweden) to 4.6 packages per 1 000 inhabitants and per day (France). The EU/EEA population-weighted mean consumption was 3.1 packages per 1 000 inhabitants and per day and did not significantly change during the period 2010–2014. Nevertheless, a significant decrease was observed for Denmark, Luxembourg, Slovenia, Spain and Sweden during 2010–2014.

Antibiotic consumption in the hospital sector

In 2014, consumption of antibiotics for systemic use in the hospital sector varied from 1.0 (the Netherlands) to 2.6 (Finland) DDD per 1 000 inhabitants and per day. Data from Finland are not exclusively reported from hospitals and include consumption in remote primary healthcare centres and nursing homes. The population-weighted EU/EEA mean consumption was 2.1 DDD per 1 000 inhabitants and per day and showed a significant increasing trend during 2010–2014. Denmark showed a significant increase over the same period.

In 2014, the population-weighted EU/EEA mean consumption of carbapenems, a last-line group of antibiotics used to treat patients infected with multidrug-resistant bacteria, showed a significant increasing trend. It also increased significantly in six countries (Bulgaria, Denmark, Hungary, Ireland, the Netherlands and Norway) during 2010–2014. Consumption of polymyxins (e.g. colistin, which is used to treat infections with carbapenem-resistant bacteria) did not significantly change at EU/EEA level (population-weighted mean), but increased significantly in three individual countries (Denmark, Hungary and Italy).

Antibiotic consumption in Europe

Antibiotic consumption data presented in this summary were collected by the European Surveillance of Antimicrobial Consumption Network (ESAC-Net) at ECDC.

The indicator 'defined daily doses (DDD) per 1 000 inhabitants and per day', based on the Anatomical Therapeutic Chemical (ATC)/DDD index, is reported for antibiotic consumption in the community (i.e. outside hospitals) and in the hospital sector. DDD is an internationally accepted unit for measuring antibiotic consumption and for making comparisons between countries. The indicator takes in consideration the amount of antibiotics (doses) consumed and its potential ecological effect on the development of antimicrobial resistance.

For antibiotic consumption in the community, a second indicator - 'packages per 1 000 inhabitants and per day' - is reported for a subset of countries which provided data on the number of packages consumed according to the ATC/DDD index. This indicator only considers orally administered antibiotics, which represent most of the antibiotics for systemic use consumed in the community. It does not take into account dosage information. Studies have shown that the indicator 'packages per 1 000 inhabitants and per day' may be a better indicator than 'DDD per 1 000 inhabitants and per day' for assessing trends of antibiotic consumption when surveillance data on antibiotic prescriptions are not available, which is the case for ESAC-Net.

In 2014, 30 EU/EEA countries reported data on antimicrobial consumption in the community expressed as DDD per 1 000 inhabitants and per day, and 21 (70%) of these countries were also able to report data on antibiotic packages. Two countries (Cyprus and Romania) were only able to report data on total consumption in the country – i.e. without differentiating between the community and the hospital sector.

In 2014, 22 countries reported data on antimicrobial consumption specifically in the hospital sector. Poland (2014) and the United Kingdom (2013, 2014) reported data on the hospital sector for the first time.

Cyprus (total care data - i.e. including the hospital sector), Portugal (separately for both sectors) and the United Kingdom (hospital sector data) reported data for 2013 which were not available last year. Croatia uploaded historical antimicrobial consumption data for the years 2000–2011, separately for both sectors. Finally, Hungary uploaded data for the hospital sector for the years 2011–2013.

For both the community and the hospital sector, these data were mainly on sales of antimicrobials in the country, or a combination of sales and reimbursement data. Spain provided reimbursement data (i.e. not including antibiotics obtained without a prescription and other non-reimbursed courses).

Inter-country comparisons of data presented in this summary should be made with caution. A few countries report on total consumption (i.e. community plus hospital sector), while most of the other countries only report data on community consumption. In addition, reporting practices may vary from year to year, even in the same country.

More details on the collection, validation and reporting of European antimicrobial consumption data are available from the public [ESAC-Net interactive database](#) (data for 1997–2014) on ECDC's website.

Consumption of antibiotics in the community, DDD per 1 000 inhabitants and per day

In 2014, consumption of antibiotics for systemic use in the community (i.e. outside hospitals) ranged from 10.6 DDD per 1 000 inhabitants and per day in the Netherlands to 34.1 DDD per 1 000 inhabitants and per day in Greece (Figure 1).

Cyprus and Romania provided data on total consumption, i.e. including both the community and the hospital sector. Nevertheless, data from these two countries are shown together with community consumption from other countries, because on average, 90% of the total consumption data corresponds to consumption in the community.

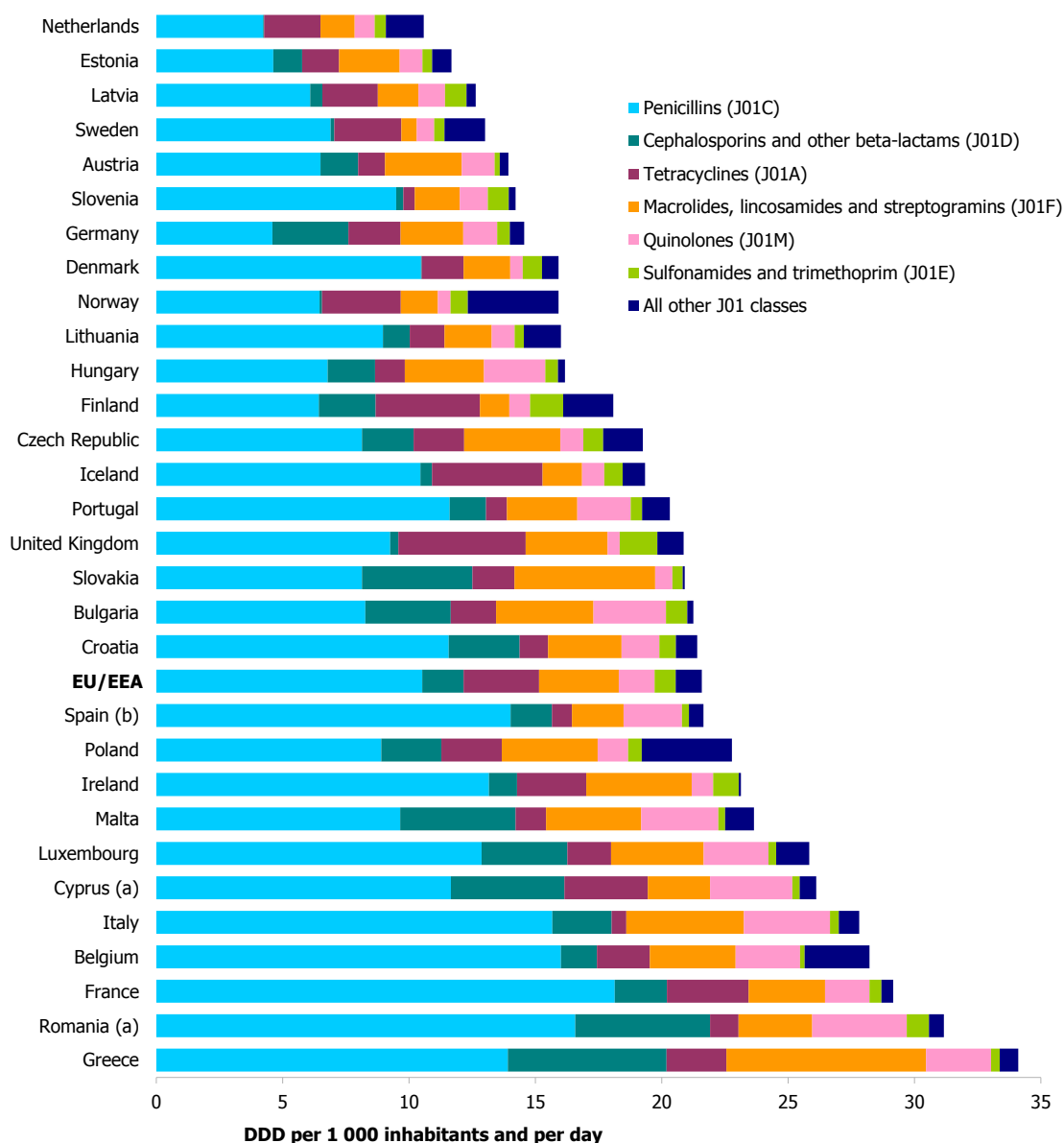
The distribution of antibiotic consumption according to the main antibiotic groups is shown in Figure 1. Each bar refers to a specific country, while the colours indicate the different antibiotic groups.

As in previous years, penicillins were the most frequently used antibiotics in all countries, ranging from 32% (Germany) to 67% (Slovenia) of the total consumption in the community, whereas the proportion of other antibiotic groups varied widely between countries – e.g. cephalosporins and other beta-lactams, from 0.2% (Denmark) to 21% (Slovakia); macrolides, lincosamides and streptogramins, from 5% (Sweden) to 27% (Slovakia); and quinolones, from 2% (United Kingdom) to 15% (Hungary) (Figure 1).

Trends in antibiotic consumption in the community (DDD per 1 000 inhabitants and per day) for 2010–2014 are presented in Table 1. The EU/EEA population-weighted mean consumption was 21.6 DDD per 1 000 inhabitants and per day, and increased significantly during the period 2010–2014.

One country (United Kingdom) reporting comparable data for all years during the period 2010–2014 showed a significant increasing trend. However, a significant decrease was observed for Cyprus and Sweden.

Figure 1. Consumption of antibiotics for systemic use in the community by antibiotic group in 30 EU/EEA countries, 2014 (expressed in DDD per 1 000 inhabitants and per day)



The figure for EU/EEA refers to the corresponding population-weighted mean consumption, calculated by adding together the products of each country’s consumption in DDD per 1 000 inhabitants and per day × country population as in Eurostat, and then dividing this sum by the total EU/EEA population.

(a) Cyprus and Romania provided total care data (i.e. including the hospital sector).

(b) Spain provided reimbursement data (i.e. not including consumption of antibiotics obtained without a prescription and other non-reimbursed courses).

Table 1. Trends in consumption of antibiotics for systemic use within the community, EU/EEA countries, 2010–2014 (expressed in DDD per 1 000 inhabitants and per day)

| Country | 2010 | 20011 | 2012 | 2013 | 2014 | Trends in antimicrobial consumption, 2010–2014 | Average annual change 2010–2014 | Statistical significance |
|----------------|-------------|-------------|-------------|-------------|-------------|--|---------------------------------|--------------------------|
| Netherlands | 11.2 | 11.4 | 11.3 | 10.8 | 10.6 | | -0.18 | n.s. |
| Estonia | 11.1 | 12.2 | 11.7 | 11.7 | 11.7 | | 0.07 | n.s. |
| Latvia | 11.9 | 12.8 | 13.0 | 13.5 | 12.6 | | 0.22 | n.s. |
| Sweden | 14.2 | 14.3 | 14.1 | 13.0 | 13.0 | | -0.36 | significant |
| Austria | 15.0 | 14.5 | 14.0 | 16.3 | 13.9 | | -0.05 | n.s. |
| Slovenia | 14.4 | 14.4 | 14.3 | 14.5 | 14.2 | | -0.03 | n.s. |
| Germany | 14.1 | 13.9 | 14.8 | 15.7 | 14.6 | | 0.28 | n.s. |
| Denmark | 16.5 | 17.4 | 16.4 | 16.4 | 15.9 | | -0.22 | n.s. |
| Norway | 15.8 | 16.5 | 16.9 | 16.2 | 15.9 | | 0.00 | n.s. |
| Lithuania | 17.8* | 19.0* | 16.2 | 18.5 | 16.01 | | | n.a. |
| Hungary | 15.9 | 16.2 | 15.1 | 15.6 | 16.2 | | -0.02 | n.a. |
| Finland | 18.5 | 20.1 | 19.5 | 18.3 | 18.1 | | -0.26 | n.s. |
| Czech Republic | 17.9 | 18.5 | 17.7 | 19.0 | 19.3 | | 0.32 | n.s. |
| Iceland | 22.3 | 22.3 | 22.1* | 21.9* | 19.3 | | -0.64 | n.a. |
| Portugal (b) | 22.4 | 23.2 | 22.7 | 19.6 | 20.3 | | | n.a. |
| United Kingdom | 18.7 | 18.8 | 20.1 | 20.6 | 20.9 | | 0.61 | significant |
| Slovakia (a) | | 23.8* | 20.0 | 23.6 | 20.9 | | | n.a. |
| Bulgaria | 18.3 | 19.5 | 18.5 | 20.0 | 21.3 | | 0.64 | n.s. |
| Croatia | 20.1 | 19.5 | 21.7 | 21.1 | 21.4 | | 0.43 | n.s. |
| EU/EEA | 20.1 | 20.8 | 21.2 | 21.8 | 21.6 | | 0.39 | significant |
| Spain | 20.3† | 20.9† | 19.7† | 20.3† | 21.6† | | 0.21 | n.s. |
| Poland (b) | 19.0 | 21.7 | 22.9 | 23.6 | 22.8 | | | n.a. |
| Ireland | 20.3 | 22.6 | 23.0 | 23.8 | 23.1 | | 0.68 | n.s. |
| Malta | 21.3 | 23.4 | 22.5 | 23.8 | 23.7 | | 0.50 | n.s. |
| Luxembourg | 27.6 | 27.8 | 27.7 | 27.7 | 25.8 | | -0.36 | n.s. |
| Cyprus | 31.1* | 32.0* | 29.7* | 28.3* | 26.1* | | -1.36 | significant |
| Italy | 27.9 | 28.2 | 27.6 | 28.6 | 27.8 | | 0.03 | n.s. |
| Belgium | 28.2 | 28.8 | 29.5 | 29.4 | 28.2 | | 0.06 | n.s. |
| France | 28.2 | 28.7 | 29.7 | 30.1 | 29.2 | | 0.33 | n.s. |
| Romania (a) | | 30.9* | 30.4* | 31.6* | 31.2* | | | n.a. |
| Greece | 39.9* | 35.7 | 32.5 | 32.2 | 34.1 | | | n.a. |

The number for EU/EEA refers to the corresponding population-weighted mean consumption, calculated by adding together the products of each country's consumption in DDD per 1 000 inhabitants and per day × country population as in Eurostat, and then dividing this sum by the total EU/EEA population.

* Total care data, including the hospital sector.

† Reimbursement data (i.e. not including consumption without a prescription and other non-reimbursed courses).

(a) Romania and Slovakia did not report data for 2010.

(b) Poland and Portugal changed the type of reported data (reimbursement versus sales data) between 2010 and 2014.

n.a.: not applicable; linear regression was not applied due to missing data, changes in the type of data or changes of sector for which data were reported (community versus total care data) between 2010 and 2014.

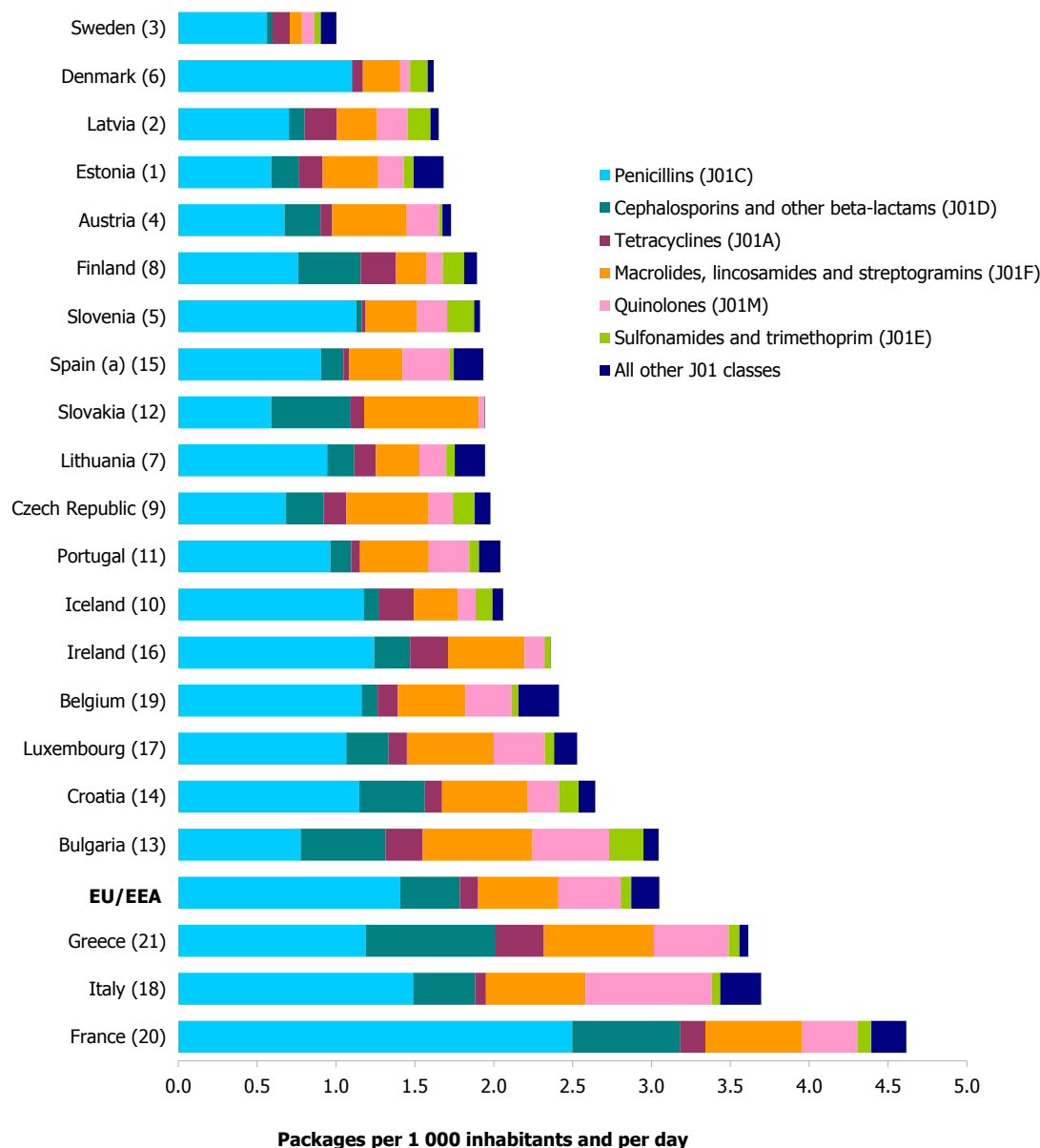
n.s.: not significant.

Consumption of antibiotics in the community, packages per 1 000 inhabitants per day

In 2014, consumption of antibiotics for systemic use in the community (i.e. outside hospitals) ranged from 1.1 packages per 1 000 inhabitants and per day in Sweden to 4.6 packages per 1 000 inhabitants and per day in France (Figure 2).

Differences in the ranking of countries according to antibiotic consumption in the community expressed as 'DDD per 1 000 inhabitants per day' and as 'packages per 1 000 inhabitants per day' probably reflect differences in the size and quantity of antibiotics in antibiotic packages.

Figure 2. Consumption of antibiotics for systemic use in the community by antibiotic group in 21 EU/EEA countries, 2014 (expressed in packages per 1 000 inhabitants and per day)



The bar for EU/EEA refers to the corresponding population-weighted mean consumption, calculated by adding together the products of each country's consumption in DDD per 1 000 inhabitants and per day \times country population as in Eurostat, and then dividing this sum by the total EU/EEA population.

The numbers in parentheses indicate the ranking of each of the 21 countries when community consumption of antibiotics for systemic use is expressed in 'DDD per 1 000 inhabitants and per day' (see Figure 1).

(a) Spain provided reimbursement data (i.e. not including consumption of antibiotics obtained without a prescription and other non-reimbursed courses).

Trends in community antibiotic consumption expressed in packages per 1 000 inhabitants and per day for the period 2010–2014 are presented in Table 2. The EU/EEA population-weighted mean consumption was 3.1 packages per 1 000 inhabitants and per day, and did not significantly increase or decrease during the period 2010–2014.

No country showed a significant increase. A significant decrease was observed for five countries (Denmark, Luxembourg, Slovenia, Spain and Sweden). The decrease in community antibiotic consumption expressed in packages per 1 000 inhabitants and per day in these countries likely reflects a decrease in antibiotic prescriptions between 2010 and 2014, although this should be confirmed with national data from other sources.

Indications for antibiotic prescriptions and detailed information on current national programmes would be required to identify the factors and reasons behind annual changes in antibiotic consumption in EU/EEA countries.

Table 2. Trends in consumption of antibiotics for systemic use in the community, EU/EEA countries, 2010–2014 (expressed in packages per 1 000 inhabitants and per day)

| Country | 2010 | 2011 | 2012 | 2013 | 2014 | Trends in consumption of antibiotics, 2010–2014 | Average annual change 2010–2014 | Statistical significance |
|----------------|-------------|-------------|-------------|-------------|-------------|---|---------------------------------|--------------------------|
| Sweden | 1.19 | 1.18 | 1.14 | 1.05 | 1.00 | | -0.05 | significant |
| Denmark | 1.79 | 1.85 | 1.70 | 1.67 | 1.62 | | -0.05 | significant |
| Latvia | 1.59 | 1.73 | 1.70 | 1.76 | 1.65 | | 0.01 | n.s. |
| Estonia | 1.70 | 1.82 | 1.77 | 1.74 | 1.68 | | -0.01 | n.s. |
| Austria | 1.88 | 1.81 | 1.76 | 2.03 | 1.73 | | -0.01 | n.s. |
| Finland | 1.96 | 2.13 | 2.04 | 1.91 | 1.89 | | -0.04 | n.s. |
| Slovenia | 2.06 | 2.02 | 1.96 | 1.97 | 1.91 | | -0.03 | significant |
| Spain | 2.13† | 2.17† | 2.01† | 1.99† | 1.93† | | -0.06 | significant |
| Slovakia (a) | | | 2.53 | 3.02 | 1.94 | | | n.a. |
| Lithuania (a) | | | 1.99 | 2.24 | 1.95 | | | n.a. |
| Czech Republic | 1.93 | 1.94 | 1.84 | 1.99 | 1.98 | | 0.01 | n.s. |
| Portugal | 2.34 | 2.38 | 2.33 | 1.99 | 2.04 | | | n.a. |
| Iceland (a) | | | | | 2.06 | | | n.a. |
| Ireland | 2.32 | 2.49 | 2.53 | 2.55 | 2.36 | | 0.02 | n.s. |
| Belgium | 2.51 | 2.53 | 2.54 | 2.51 | 2.41 | | -0.02 | n.s. |
| Luxembourg | 2.83 | 2.74 | 2.68 | 2.67 | 2.53 | | -0.07 | significant |
| Croatia | 2.58 | 2.48 | 2.67 | 2.61 | 2.64 | | 0.03 | n.s. |
| Bulgaria | 2.77 | 2.92 | 2.78 | 2.90 | 3.04 | | 0.05 | n.s. |
| EU/EEA | 3.03 | 3.14 | 3.15 | 3.18 | 3.05 | | -0.04 | n.s. |
| Greece (a) | | 3.86 | 3.48 | 3.52 | 3.61 | | | n.a. |
| Italy | 3.84 | 3.78 | 3.70 | 3.83 | 3.70 | | -0.03 | n.s. |
| France | 4.82 | 4.86 | 4.86 | 4.85 | 4.62 | | -0.04 | n.s. |

The number for EU/EEA refers to the corresponding population-weighted mean consumption, calculated by adding together the products of each country's consumption in DDD per 1 000 inhabitants and per day × country population as in Eurostat, and then dividing this sum by the total EU/EEA population.

† Reimbursement data (i.e. not including consumption without a prescription and other non-reimbursed courses).

(a) Countries that did not report data for all years during the period 2010–2013.

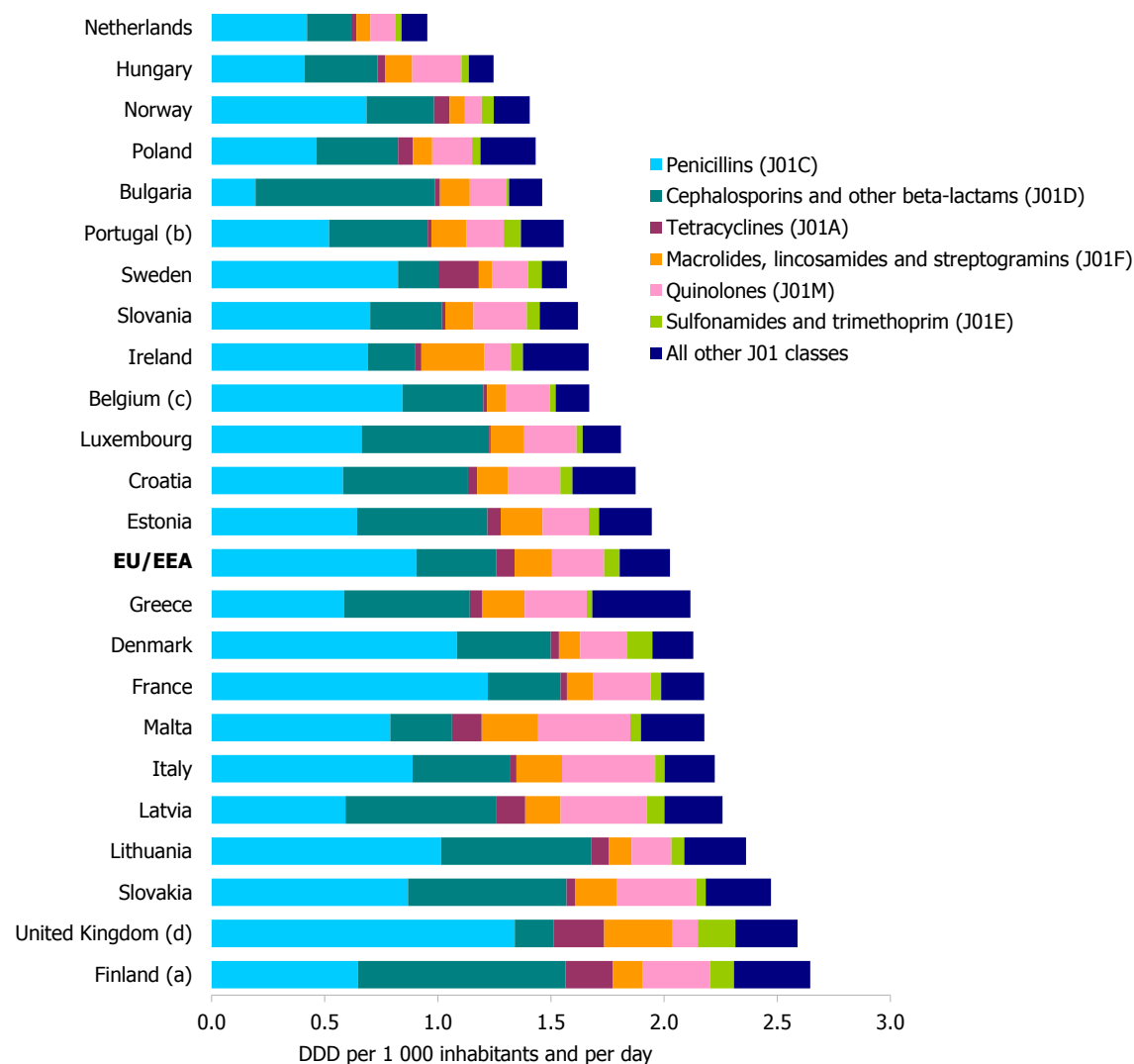
n.a.: not applicable; linear regression was not applied due to missing data, or changes in the type of data between 2010 and 2014 (Portugal).

n.s.: not significant.

Consumption of antibiotics in the hospital sector

In 2014, consumption of antibiotics for systemic use in the hospital sector ranged from 1.0 DDD per 1 000 inhabitants and per day in the Netherlands to 2.6 DDD per 1 000 inhabitants and per day in Finland (Figure 3). However, data from Finland are not exclusively reported from hospitals and include consumption in remote primary healthcare centres and nursing homes.

Figure 3. Consumption of antibiotics for systemic use in the hospital sector by antibiotic group in 23 EU/EEA countries, 2014 (expressed in DDD per 1 000 inhabitants and per day)



The bar for EU/EEA refers to the corresponding population-weighted mean consumption, calculated by adding together the products of each country's consumption in DDD per 1 000 inhabitants and per day \times country population as in Eurostat, and then dividing this sum by the total EU/EEA population.

- (a) Finland: data include consumption in remote primary healthcare centres and nursing homes.
 (b) Portugal: data relate to public hospitals only.
 (c) Belgium: data from 2013.
 (d) United Kingdom: data do not include consumption from UK-Northern Ireland (2014)

Figure 3 also shows the distribution of consumption for the main antibiotic groups in the hospital sector, expressed in DDD per 1 000 inhabitants and per day. Each bar refers to a specific country while the colours indicate the different antibiotic groups.

The relative proportion of consumption for various antibiotic groups in the hospital sector varied widely among countries (Figure 3). In contrast to prescribing practices in the community, penicillins were not the most frequently prescribed antibiotic group in the hospital sector for all countries.

In the hospital sector, the proportions of cephalosporins, other beta-lactams (including carbapenems) and other groups of antibiotics were generally higher than in the community. However, substantial variations were reported in the proportions of different antibiotic groups used in hospitals: consumption of cephalosporins and other beta-

lactams, including carbapenems, ranged from 7% in the United Kingdom to 55% in Bulgaria; consumption of macrolides, lincosamides and streptogramins ranged from 3% in Sweden to 17% in Ireland; and consumption of quinolones ranged from 4% in the United Kingdom to 19% in Malta.

Trends in consumption of antibiotics for systemic use in the hospital sector expressed in DDD per 1 000 inhabitants and per day for the period 2010–2014 are presented in Table 3. The EU/EEA population-weighted mean consumption was 2.1 DDD per 1 000 inhabitants and per day and increased significantly during the period 2010–2014. Although a significant increase was observed for Denmark, no country showed a significant decrease.

Table 3. Trends in consumption of antibiotics for systemic use in the hospital sector in EU/EEA countries, 2010–2014 (expressed in DDD per 1 000 inhabitants and per day)

| Country | 2010 | 2011 | 2012 | 2013 | 2014 | Trends in antimicrobial consumption, 2010–2014 | Average annual change 2010–2014 | Statistical significance |
|-----------------------|------------|------------|------------|------------|------------|--|---------------------------------|--------------------------|
| Netherlands | 1.1 | 1.0 | 1.0 | 1.0 | 1.0 | | -0.02 | n.a. |
| Hungary | 1.4 | 1.2 | 1.2 | 1.2 | 1.2 | | -0.02 | n.s. |
| Norway | 1.4 | 1.5 | 1.4 | 1.4 | 1.4 | | -0.01 | n.s. |
| Poland (a) | | | | | 1.4 | | | n.a. |
| Bulgaria | 1.5 | 1.5 | 1.4 | 1.4 | 1.5 | | -0.01 | n.s. |
| Portugal (c) | 1.4 | 1.5 | 1.5 | 1.6 | 1.6 | | 0.05 | n.s. |
| Sweden | 1.5 | 1.6 | 1.7 | 1.7 | 1.6 | | 0.02 | n.s. |
| Slovenia | 1.7 | 1.7 | 1.6 | 1.6 | 1.6 | | -0.03 | n.s. |
| Ireland | 1.8 | 1.8 | 1.8 | 1.8 | 1.7 | | -0.03 | n.s. |
| Luxembourg | 2.1 | 2.0 | 2.0 | 2.0 | 1.8 | | -0.06 | n.s. |
| Croatia | 1.8 | 1.9 | 2.0 | 1.8 | 1.9 | | <0.01 | n.s. |
| Estonia | 1.9 | 1.9 | 2.1 | 1.9 | 1.9 | | 0.02 | n.s. |
| EU/EEA | 1.9 | 2.0 | 2.0 | 2.1 | 2.0 | | 0.03 | significant |
| Greece (a) | | 2.2 | 2.1 | 2.0 | 2.1 | | | n.a. |
| Denmark | 1.8 | 1.7 | 1.8 | 2.0 | 2.1 | | 0.10 | significant |
| France | 2.2 | 2.1 | 2.1 | 2.2 | 2.2 | | -0.01 | n.s. |
| Malta | 2.0 | 1.7 | 1.4 | 1.7 | 2.2 | | 0.05 | n.s. |
| Italy | 2.2 | 2.3 | 2.5 | 2.2 | 2.2 | | 0.00 | n.s. |
| Latvia | 3.2 | 2.4 | 2.3 | 2.3 | 2.3 | | -0.20 | n.s. |
| Lithuania (a) | | | 2.4 | 2.4 | 2.4 | | | n.a. |
| Slovakia (a) | | | 2.0 | 2.3 | 2.5 | | | n.a. |
| United Kingdom (a)(d) | | | | 2.5 | 2.6 | | | n.a. |
| Finland (b) | 2.8 | 3.1 | 2.8 | 2.8 | 2.6 | | -0.07 | n.s. |
| Belgium (a) | 2.0 | 2.0 | 1.7 | 1.7 | | | | n.a. |

The number for EU/EEA refers to the corresponding population-weighted mean consumption, calculated by summing the products of each country's consumption in DDD per 1 000 inhabitants and per day × country population as in Eurostat, and then dividing this sum by the total EU/EEA population.

(a) These countries did not report data for all years during the period 2010–2014.

(b) Finland: data include consumption in remote primary healthcare centres and nursing homes.

(c) Portugal: data relate to public hospitals only.

(d) United Kingdom: data do not include consumption from UK-Wales (2013) UK-Northern Ireland (2014)

n.a.: not applicable; linear regression was not applied due to missing data.

n.s.: not significant.

Consumption of specific antibiotic groups used for the treatment of patients infected with multidrug-resistant bacteria

The spread of multidrug-resistant bacteria in healthcare facilities has become a public health threat. One significant driver for the selection of multidrug-resistant bacteria responsible for healthcare-associated infections in hospitalised patients is the use of specific, mostly reserve or last-line antibiotics in hospitals. Patients receiving antibiotics are more likely to be colonised with multidrug-resistant bacteria and therefore are at greater risk of developing subsequent infections with these bacteria than patients who do not receive antibiotics. Additionally, antibiotic pressure due to high levels of antimicrobial use in hospitals can be a risk factor for the acquisition of multidrug-resistant bacteria.

Carbapenems are a last-line group of antibiotics and are mainly used in hospitals for treatment of patients with confirmed or suspected infections involving a multidrug-resistant bacterium.

Use of a carbapenem antibiotic is a risk factor for subsequent infection with a carbapenem-resistant bacterium such as carbapenemase-producing Enterobacteriaceae, carbapenem-resistant *Acinetobacter baumannii* or carbapenem-resistant *Pseudomonas aeruginosa*.

Carbapenem-resistant bacteria are highly drug-resistant and only a few antibiotic groups such as polymyxins (e.g. colistin) are available for the treatment of patients infected with such bacteria.

Trends in the consumption of carbapenems for the period 2010–2014 are presented in Table 4. During this period, the EU/EEA population-weighted mean consumption of carbapenems showed a significant increase. In 2014, consumption of carbapenems was 0.06 DDD per 1 000 inhabitants and per day. Assuming that the average duration of treatment is 10 days, this corresponds to more than one million carbapenem prescriptions issued in the EU/EEA each year. A significant increase was observed for six countries (Bulgaria, Denmark, Hungary, Ireland, the Netherlands and Norway). None of the countries that reported data for all years during 2010–2014 showed a significant decreasing trend.

Trends in the consumption of polymyxins for the period 2010–2014 are presented in Table 5. The EU/EEA population-weighted mean consumption of polymyxins did not significantly change during this period. In 2014, the consumption of polymyxins was 0.012 DDD per 1 000 inhabitants and per day. A significant increase was observed for three countries (Italy, Hungary and Norway). None of the countries reporting comparable data for all years during 2010–2014 showed a significant decreasing trend.

In the EU/EEA, consumption of carbapenems and polymyxins is still at a low level compared to the overall consumption of antibiotics for systemic use in the hospital sector, but significant increasing trends in the consumption of these antibiotic groups are reported from several countries.

The latest data from the European Antimicrobial Resistance Surveillance Network (EARS-Net) show a significant increase in the population-weighted EU/EEA mean percentage of carbapenem resistance in *Klebsiella pneumoniae* in invasive patient isolates. The increasing spread of carbapenem-resistant Enterobacteriaceae (mostly *Klebsiella pneumoniae*) has been confirmed in a recent survey of national experts from 38 European countries¹.

A joint report by ECDC, the European Food Safety Authority and the European Medicines Agency published earlier this year showed a strong association between carbapenem consumption (data from ESAC-Net) and the percentage of *Klebsiella pneumoniae* invasive isolates that are carbapenem resistant (data from EARS-Net) in EU/EEA countries reporting data to both networks².

¹ Barbara Albiger, Corinna Glasner, Marc J. Struelens, Hajo Grundmann, Dominique L. Monnet and the European Survey on Carbapenemase-Producing Enterobacteriaceae (EuSCAPE) working group. EUROROUNDUPS. Carbapenemase-producing Enterobacteriaceae in Europe: assessment by national experts from 38 countries. Euro Surveill. In press 2015.

² ECDC (European Centre for Disease Prevention and Control), EFSA (European Food Safety Authority) and EMA (European Medicines Agency). ECDC/EFSA/EMA first joint report on the integrated analysis of the consumption of antimicrobial agents and occurrence of antimicrobial resistance in bacteria from humans and food-producing animals. Stockholm/Parma/London: ECDC/EFSA/EMA, 2015. EFSA Journal 2015;13(1):4006, 114 pp. doi:10.2903/j.efsa.2015.4006

Table 4. Trends in consumption of carbapenems in the hospital sector for EU/EEA countries, 2010–2014 (expressed in DDD per 1 000 inhabitants and per day)

| Country | 2010 | 2011 | 2012 | 2013 | 2014 | Trends in consumption of carbapenems, 2010–2014 | Average annual change 2010–2014 | Statistical significance |
|-----------------------|--------------|--------------|--------------|--------------|--------------|---|---------------------------------|--------------------------|
| Netherlands | 0.015 | 0.018 | 0.019 | 0.020 | 0.019 | | 0.001 | significant |
| Bulgaria | 0.010 | 0.013 | 0.013 | 0.014 | 0.020 | | 0.002 | significant |
| Poland (a) | | | | | 0.024 | | | n.a. |
| Latvia | 0.048 | 0.029 | 0.019 | 0.022 | 0.027 | | -0.005 | n.s. |
| France | 0.027 | 0.030 | 0.021 | 0.033 | 0.033 | | 0.002 | n.s. |
| Lithuania (a) | | | 0.026 | 0.026 | 0.033 | | | n.a. |
| Hungary | 0.027 | 0.028 | 0.032 | 0.037 | 0.042 | | 0.004 | significant |
| Slovakia (a) | | | 0.027 | 0.034 | 0.042 | | | n.a. |
| Estonia | 0.027 | 0.036 | 0.036 | 0.033 | 0.043 | | 0.003 | n.s. |
| Norway | 0.044 | 0.044 | 0.045 | 0.046 | 0.047 | | <0.001 | significant |
| Sweden | 0.052 | 0.052 | 0.053 | 0.056 | 0.053 | | <0.001 | n.s. |
| EU/EEA | 0.046 | 0.048 | 0.053 | 0.060 | 0.058 | | 0.004 | significant |
| Slovenia | 0.067 | 0.078 | 0.074 | 0.061 | 0.066 | | -0.002 | n.s. |
| United Kingdom (a)(d) | | | | 0.064 | 0.071 | | | n.a. |
| Croatia | 0.055 | 0.058 | 0.065 | 0.060 | 0.073 | | 0.004 | n.s. |
| Italy | 0.069 | 0.039 | 0.073 | 0.076 | 0.081 | | 0.006 | n.s. |
| Finland (b) | 0.081 | 0.094 | 0.074 | 0.088 | 0.081 | | <0.001 | n.s. |
| Denmark | 0.056 | 0.060 | 0.063 | 0.087 | 0.085 | | 0.008 | significant |
| Luxembourg | 0.096 | 0.086 | 0.101 | 0.095 | 0.087 | | -0.001 | n.s. |
| Malta | 0.077 | 0.105 | 0.052 | 0.066 | 0.101 | | 0.001 | n.s. |
| Ireland | 0.058 | 0.057 | 0.061 | 0.088 | 0.109 | | 0.013 | significant |
| Portugal (c) | 0.141 | 0.139 | 0.143 | 0.146 | 0.139 | | <0.001 | n.s. |
| Greece (a) | | 0.130 | 0.133 | 0.135 | 0.143 | | | n.a. |
| Belgium (a) | 0.068 | 0.079 | 0.062 | 0.062 | | | | n.a. |

The number for EU/EEA refers to the corresponding population-weighted mean consumption, calculated by summing the products of each country's consumption in DDD per 1 000 inhabitants and per day × country population as in Eurostat, and then dividing this sum by the total EU/EEA population.

(a) These countries did not report data for all years during the period 2010–2014.

(b) Finland: data include consumption in remote primary healthcare centres and nursing homes.

(c) Portugal: data relate to public hospitals only.

(d) United Kingdom: data do not include consumption from UK-Wales (2013) or UK-Northern Ireland (2014).

n.a.: not applicable; linear regression was not applied due to missing data.

n.s.: not significant.

Table 5. Trends in consumption of polymyxins in EU/EEA countries, 2010–2014 (expressed in DDD per 1 000 inhabitants and per day)

| Country | 2010 | 2011 | 2012 | 2013 | 2014 | Trends in consumption of polymyxins, 2010–2014 | Average annual change 2010–2014 | Statistical significance |
|-----------------------|--------------|--------------|--------------|--------------|--------------|--|---------------------------------|--------------------------|
| Finland (b) | 0 | 0 | 0 | 0 | 0 | | | n.a. |
| Lithuania (a) | | | 0 | 0 | 0 | | | n.a. |
| Norway | 0.0002 | 0.0004 | 0.0006 | 0.0006 | 0.0006 | | <0.001 | significant |
| Poland (a) | | | | | 0.001 | | | n.a. |
| Latvia | 0 | 0 | 0.003 | 0.002 | 0.001 | | <0.001 | n.s. |
| Sweden | 0.000 | 0.001 | 0.001 | 0.001 | 0.001 | | <0.001 | n.s. |
| Netherlands | 0.006 | 0.003 | 0.002 | 0.003 | 0.002 | | -0.001 | n.s. |
| Bulgaria | 0 | 0 | 0 | 0 | 0.002 | | <0.001 | n.s. |
| Estonia | <0.001 | <0.001 | 0.002 | 0 | 0.002 | | <0.001 | n.s. |
| Denmark | 0.002 | 0.002 | 0.002 | 0.001 | 0.003 | | <0.001 | n.s. |
| Luxembourg | 0.005 | 0.005 | 0.005 | 0.006 | 0.003 | | <0.001 | n.s. |
| Slovenia | 0.001 | 0.002 | 0.003 | 0.003 | 0.005 | | 0.001 | n.s. |
| United Kingdom (a)(d) | | | | 0.005 | 0.006 | | | n.a. |
| Hungary | 0.002 | 0.004 | 0.005 | 0.006 | 0.007 | | 0.001 | significant |
| France | 0.008 | 0.008 | 0.008 | 0.008 | 0.008 | | <0.001 | n.s. |
| Malta | 0.026 | 0.004 | 0.002 | 0.006 | 0.011 | | 0.003 | n.s. |
| EU/EEA | 0.008 | 0.011 | 0.014 | 0.012 | 0.012 | | <0.001 | n.s. |
| Ireland | 0.014 | 0.014 | 0.015 | 0.015 | 0.013 | | <0.001 | n.s. |
| Portugal (c) | 0.013 | 0.018 | 0.019 | 0.020 | 0.019 | | 0.001 | n.s. |
| Croatia | 0.055 | 0.010 | 0.029 | 0.003 | 0.019 | | 0.008 | n.s. |
| Slovakia (a) | | | 0.020 | 0.023 | 0.025 | | | n.a. |
| Italy | 0.012 | 0.011 | 0.019 | 0.023 | 0.025 | | 0.004 | significant |
| Greece (a) | | 0.078 | 0.085 | 0.084 | 0.095 | | | n.a. |
| Belgium | 0.008 | 0.009 | 0.006 | 0.008 | | | | n.a. |

The number for EU/EEA refers to the corresponding population-weighted mean consumption, calculated by summing the products of each country's consumption in DDD per 1 000 inhabitants and per day × country population as in Eurostat, and then dividing this sum by the total EU/EEA population.

(a) These countries did not report data for all years during the period 2010–2014.

(b) Finland: data include consumption in remote primary healthcare centres and nursing homes.

(c) Portugal: data relate to public hospitals only.

(d) United Kingdom: data do not include consumption from UK-Wales (2013) or UK-Northern Ireland (2014).

n.a.: not applicable; linear regression was not applied due to missing data.

n.s.: not significant.