

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

November 2014

- Reliable data on antimicrobial consumption are paramount to our understanding of antibiotic resistance epidemiology in Europe, as antibiotic use is one of the main factors responsible for antibiotic resistance.
- Although most antibiotic consumption occurs in the community (outside hospitals), antibiotic use in hospitals is a main driver for the spread of multidrug-resistant bacteria responsible for healthcare-associated infections.
- During 2009–2013, overall antibiotic consumption, expressed in defined daily doses (DDD) per 1 000 inhabitants and per day, significantly increased in the community among the EU Member States, although the situation varied widely from country to country, with some showing a significant increase and others a significant decrease.

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-level provide important information for healthcare professionals, in conjunction with additional national or regional data, for evaluating 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 2013, consumption of antibiotics for systemic use in the community ranged from 10.8 defined daily doses (DDD) per 1 000 inhabitants and per day (the Netherlands) to 32.0 DDD per 1 000 inhabitants and per day (Greece); a 2.9-fold difference, which is similar to previous years. The population-weighted EU/EEA mean consumption was 22.4 DDD per 1 000 inhabitants and per day, representing a continuing increase over the last five years for the EU as a whole, as well as for six individual countries.

Using another indicator, packages per 1 000 inhabitants and per day, consumption of antibiotics for systemic use in the community in 2013 ranged from 1.1 packages per 1 000 inhabitants and per day (Sweden) to 4.9 packages per 1 000 inhabitants and per day (France). The EU/EEA population-weighted mean consumption was 3.3 packages per 1 000 inhabitants and per day and did not significantly increase or decrease during the period 2009–2013. No country showed a significant increase and the only significant decrease observed was for Slovenia.

Studies have shown that the indicator 'packages per 1 000 inhabitants and per day' may be better than 'DDD per 1 000 inhabitants and per day' for assessing trends in antibiotic consumption in the community. This is because the number of packages of antibiotics better reflects the number of antibiotic prescriptions than the number of DDD.

Antibiotic consumption in the hospital sector

In 2013, the population-weighted EU/EEA mean consumption of antibiotics for systemic use in the hospital sector was 2.0 DDD per 1 000 inhabitants and per day and showed no significant trend during 2009–2013. In 2013, consumption varied from 1.0 (the Netherlands) to 2.8 (Finland) DDD per 1 000 inhabitants and per day. However, data from Finland are not exclusively reported from hospitals and include consumption in remote primary health care centres and nursing homes.

The relative proportions of consumption for various antibiotic groups in the hospital sector varied widely between countries. In contrast to prescribing practices in the community, penicillins were not the most frequently prescribed antibiotic group in all countries.

The population-weighted EU/EEA mean consumption of carbapenems and polymyxins, two groups of antibiotics used to treat patients infected with multidrug-resistant bacteria, increased significantly during 2009–2013.

Erratum, 2 December 2015: The expression 'DDD' in the legends for Figure 2 and Table 2 has been replaced with 'packages'.

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, with the exception of the 2009 data, which were collected by the European Surveillance of Antimicrobial Consumption (ESAC) project that was previously coordinated by the University of Antwerp.

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.

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 index. This indicator only considers orally administered antibiotics which, for the countries that participate in ESAC-Net, represent most of the antibiotics for systemic use consumed in the community.

Twenty-eight EU/EEA countries reported data on antimicrobial consumption in the community expressed as DDD per 1 000 inhabitants and per day. Among these countries only 19 countries were able to report additional data on antibiotic packages.

Two countries (Iceland 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).

Nineteen countries reported data on antimicrobial consumption specifically in the hospital sector.

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, as certain 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 in the [ESAC-Net 2012 report](#) (published on 29 September 2014) and from the public [ESAC-Net interactive database](#) (data for 1997–2013) on the ECDC website.

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

In 2013, consumption of antibiotics for systemic use in the community (i.e. outside hospitals) ranged from 10.8 DDD per 1 000 inhabitants and per day in the Netherlands to 32.0 DDD per 1 000 inhabitants and per day in Greece (Figure 1).

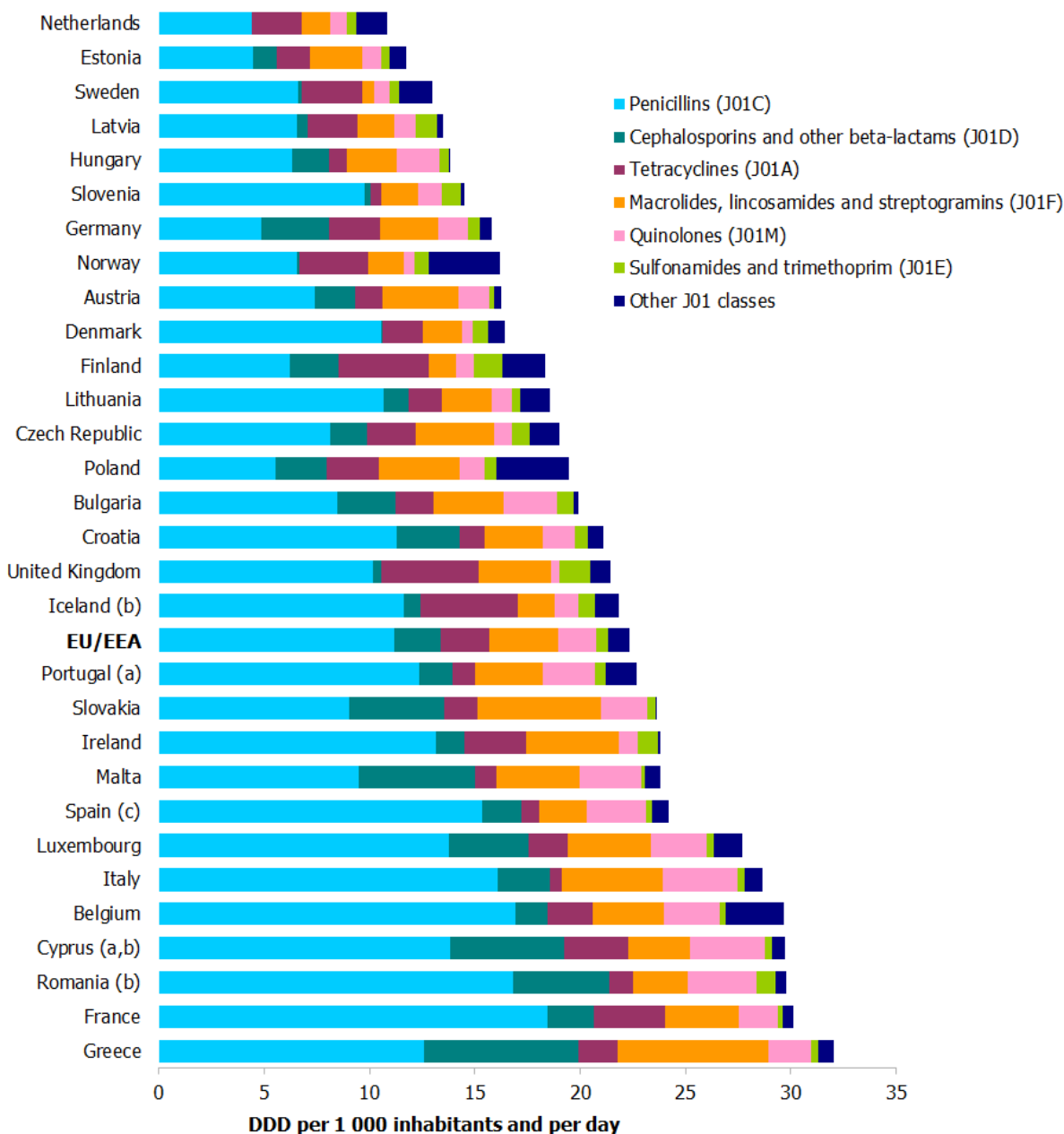
Iceland and Romania provided data on total consumption, i.e. including both the community and the hospital sector. Nevertheless, data from these two countries are shown together with community consumption from other countries, because on average, 90% of the total care data corresponds to consumption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

The distribution of antibiotic consumption according to the main antibiotic groups is also 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 28% (Poland) to 67% (Slovenia), whereas the proportion of other antibiotic groups varied widely between countries – e.g. cephalosporins and other beta-lactams, from 0.2% (Denmark) to 23% (Malta); macrolides, lincosamides and streptogramins, from 5% (Sweden) to 25% (Slovakia); and quinolones, from 2% (United Kingdom) to 14% (Hungary) (Figure 1).

Trends in antibiotic consumption in the community (in DDD per 1 000 inhabitants and per day) for 2009–2013 are presented in Table 1. The EU/EEA population-weighted mean consumption was 22.4 DDD per 1 000 inhabitants and per day and significantly increased during the period 2009–2013. A significant increase was also observed for six countries (Belgium, Ireland, Latvia, Norway, Spain and the United Kingdom). None of the countries reporting comparable data for all years during the period 2009–2013 showed a significant decreasing trend.

Figure 1. Consumption of antibiotics for systemic use in the community by antibiotic group in 30 EU/EEA countries, 2013 (expressed in DDD per 1 000 inhabitants and per day)



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's population as in Eurostat, and then dividing this sum by the total EU/EEA population.

(a) For Cyprus and Portugal, data for 2012.

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

(c) 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, 2009–2013 (expressed in DDD per 1 000 inhabitants and per day)

Country	2009	2010	2011	2012	2013	Trends in consumption of antibiotics, 2009–2013	Average annual change 2009–2013	Statistical significance
Netherlands	11.4	11.2	11.4	11.3	10.8		-0.09	n.s.
Estonia	11.1	11.1	12.2	11.7	11.7		0.20	n.s.
Sweden	14.1	14.2	14.3	14.1	13.0		-0.23	n.s.
Latvia	10.9	11.8	12.8	13.0	13.5		0.53	significant
Hungary (b)	16.0	15.9	14.7	13.6	13.8			n.a.
Slovenia	14.3	14.4	14.4	14.3	14.5		0.03	n.s.
Germany	14.9	14.5	14.1	14.9	15.8		0.22	n.s.
Norway	15.2	15.8	16.5	16.9	16.2		0.31	significant
Austria	15.5	15.0	14.5	14.0	16.3		0.06	n.s.
Denmark	15.6	16.5	17.4	16.4	16.4		0.16	n.s.
Finland	17.9	18.5	20.1	19.5	18.3		0.19	n.s.
Lithuania	19.5*	17.7*	19.0*	16.19	18.5			n.a.
Czech Republic	18.4	17.9	18.5	17.5	19.0		0.08	n.s.
Poland (b)	23.6	21.0	21.9	22.6	19.5			n.a.
Bulgaria	18.3	18.2	19.5	18.5	19.9		0.34	n.s.
Croatia (a)				21.7	21.1			n.a.
United Kingdom	17.3	18.7	18.8	20.1	21.5		0.97	significant
Iceland	19.4	22.3*	22.3*	22.1*	21.9*			n.a.
EU/EEA	20.9	21.0	21.6	21.8	22.4		0.38	significant
Slovakia (a)	23.8		23.8*	20.0	23.6			n.a.
Ireland	20.8	20.3	22.6	23.0	23.8		0.88	significant
Malta	21.6	21.3	23.4	22.5	23.8		0.56	n.s.
Spain	19.7†	20.3†	20.9†	20.9†	24.2†		0.96	significant
Luxembourg	28.2	28.6	27.6	27.9	27.7		-0.18	n.s.
Italy	28.7	27.9	28.2	27.6	28.6		-0.04	n.s.
Belgium	27.5	28.4	29.0	29.8	29.6		0.55	significant
Romania (a) (b)	10.2†		30.9*	30.4*	29.8*			n.a.
France	29.6	28.2	28.7	29.7	30.1		0.26	n.s.
Greece	38.6	39.8*	35.7	32.4	32.0			n.a.
Cyprus (a)	34.4*	31.1*	32.0*	29.7*				n.a.
Portugal (a)	22.9	22.4	23.2	22.7				n.a.

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's 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) Croatia (2009–2011), Cyprus (2013), Portugal (2013), Romania (2008 and 2010) and Slovakia (2010) did not report data for these years.

(b) Hungary, Poland and Romania changed the type of reported data (reimbursement versus sales data) between 2009 and 2013.

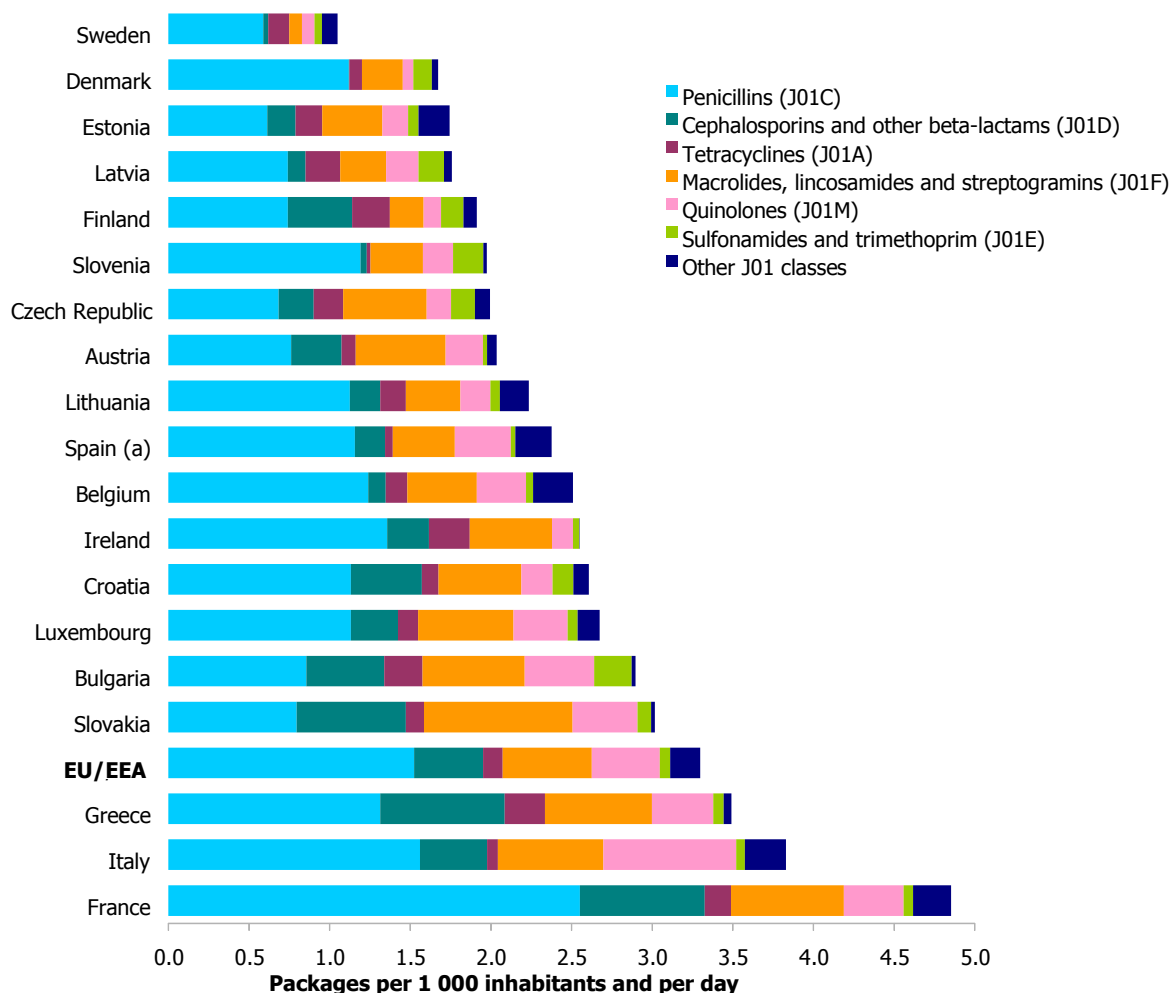
n.a.: not applicable; linear regression was not applied due to missing data.

n.s.: not significant.

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

In 2013, 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 4.9 packages per 1 000 inhabitants and per day in France (Figure 2).

Figure 2. Consumption of antibiotics for systemic use in the community by antibiotic group in 19 EU/EEA countries, 2013 (expressed as packages per 1 000 inhabitants and per day)



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

(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 2009–2013 are presented in Table 2. The EU/EEA population-weighted mean consumption was 3.3 packages per 1 000 inhabitants and per day, but did not significantly increase or decrease during 2009–2013. The only significant decrease observed was for Slovenia.

Table 2. Trends in consumption of antibiotics for systemic use in the community, EU/EEA countries, 2009–2013 (expressed in packages per 1 000 inhabitants and per day)

Country	2009	2010	2011	2012	2013	Trends in consumption of antibiotics, 2009–2013	Average annual change 2009–2013	Statistical significance
Sweden	1.18	1.19	1.18	1.14	1.05		-0.03	n.s.
Denmark	1.72	1.79	1.85	1.70	1.67		-0.02	n.s.
Estonia	1.66	1.70	1.82	1.77	1.74		0.02	n.s.
Latvia		1.59	1.73	1.70	1.76			n.a.
Finland	1.89	1.96	2.13	2.04	1.91		0.01	n.s.
Slovenia	2.12	2.06	2.02	1.96	1.97		-0.04	significant
Czech Republic		1.93	1.94	1.84	1.99			n.a.
Austria	1.95	1.88	1.80	1.76	2.03		0.01	n.s.
Lithuania				1.99	2.24			n.a.
Spain		2.13†	2.17†	2.14†	2.38†			n.a.
Belgium	2.49	2.51	2.53	2.54	2.51		0.01	n.s.
Ireland (a)		2.32	2.49	2.52	2.55			n.a.
Croatia (a)				2.67	2.61			n.a.
Luxembourg		2.93	2.73	2.70	2.67			n.a.
Bulgaria	2.72	2.77	2.92	2.78	2.90		0.04	n.s.
Slovakia (a)				2.53	3.02			n.a.
EU/EEA	2.25	3.22	3.26	3.17	3.30		0.21	n.s.
Greece (a)	4.24		3.86	3.47	3.49			n.a.
Italy (a)		3.84	3.78	3.70	3.83			n.a.
France		4.82	4.86	4.86	4.85			n.a.
Netherlands	1.51							n.a.
Portugal (a)	2.41	2.34	2.38	2.33				n.a.

EU/EEA refers to the corresponding population-weighted mean consumption, calculated by adding together the products of each country's consumption in packages per 1 000 inhabitants and per day × country's 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 2009–2013.

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

n.s.: not significant.

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' are probably due to differences in the size and quantity of antibiotics in antibiotic packages.

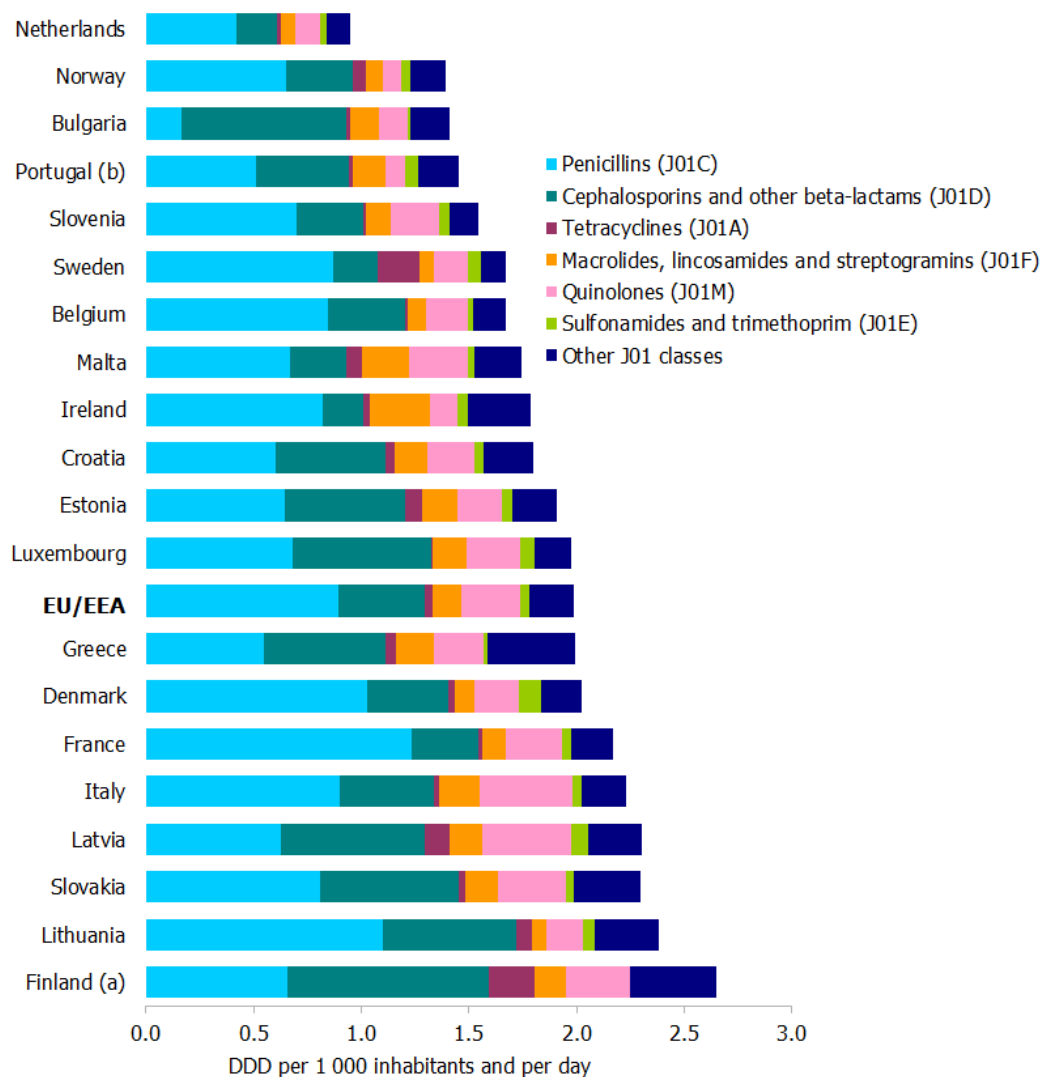
Studies have shown that the indicator 'packages per 1 000 inhabitants per day' may be a better indicator than 'DDD per 1 000 inhabitants per day' to assess trends in antibiotic consumption in the community related to the frequency of prescriptions. This is because the number of packages of antibiotics better reflects the number of antibiotic prescriptions than the number of DDD.

Nevertheless, 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 within EU/EEA countries.

Consumption of antibiotics in the hospital sector

In 2013, 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 2.8 DDD per 1 000 inhabitants and per day in Finland (Figure 4). However, data from Finland are not exclusively reported from hospitals and include consumption in remote primary healthcare centres and nursing homes.

Figure 4. Consumption of antibiotics for systemic use in the hospital sector by antibiotic group in 20 EU/EEA countries, 2013*



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's 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 for 2012 relate to public hospitals only.

Figure 4 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 4). In contrast to prescribing practices in the community, penicillins were not the most frequently prescribed antibiotic group in all countries.

* Data expressed in DDD per 1 000 inhabitants and per day

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 antimicrobials used in hospitals: consumption of cephalosporins and other beta-lactams, including carbapenems, ranged from 11% in Ireland to 55% in Bulgaria; consumption of macrolides, lincosamides and streptogramins ranged from 3% in Lithuania to 16% in Ireland; and consumption of quinolones ranged from 6.0% in Norway to 19% in Italy.

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 2009–2013 are presented in Table 3. The EU/EEA population-weighted mean consumption was 2.0 DDD per 1 000 inhabitants and per day and did not change significantly during the period 2009–2013. A significant increase was observed for Sweden, while the consumption of antibiotics for systemic use decreased significantly in Slovenia during this period.

Table 3. Trends in consumption of antibiotics for systemic use in the hospital sector in EU/EEA countries, 2009–2013 (expressed as DDD per 1 000 inhabitants and per day)

Country	2009	2010	2011	2012	2013		Trends in consumption of antibiotics, 2009–2013	Average annual change 2009–2013	Statistical significance
Netherlands		1.1	1.0	1.0	1.0				n.a.
Norway	1.5	1.4	1.5	1.4	1.4			-0.01	n.s.
Bulgaria	1.6	1.4	1.4	1.4	1.4			-0.03	n.s.
Slovenia	1.8	1.7	1.7	1.6	1.5			-0.06	significant
Sweden	1.5	1.5	1.6	1.6	1.7			0.05	significant
Belgium (a)		2.0	2.0	1.7	1.7				n.a.
Malta	1.4	2.0	1.7	1.4	1.7			0.02	n.s.
Ireland	1.4	1.8	1.8	1.8	1.8			0.08	n.s.
Croatia (a)				2.0	1.8				n.a.
Estonia	1.6	1.8	1.9	2.1	1.9			0.08	n.s.
Luxembourg (a)		2.1	2.0	2.0	2.0				n.a.
EU/EEA	2.1	2.0	2.0	2.0	2.0			-0.02	n. s.
Greece (a)	3.3		2.2	2.1	2.0				n.a.
Denmark	1.8	1.8	1.7	1.8	2.0			0.04	n.s.
France	2.2	2.2	2.1	2.1	2.2			-0.02	n.s.
Italy (a)		2.2	2.3	2.5	2.2				n.a.
Slovakia (a)	1.9			2.0	2.3				n.a.
Latvia	2.3	3.2	2.4	2.3	2.3			-0.08	n.s.
Lithuania (a)				2.4	2.4				n.a.
Finland (b)	3.2	2.8	3.1	2.8	2.8			-0.08	n.s.
Hungary (a)	1.3	1.4							n.a.
Portugal (a) (c)	1.4	1.4	1.5	1.5					n.a.
Romania (a)	2.6	0.9							n.a.

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's 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 2009–2013.

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

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

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

Trends in the consumption of carbapenems for the period 2009–2013 are presented in Table 4. The EU/EEA population-weighted mean consumption of carbapenems significantly increased from 0.043 DDD per 1 000 inhabitants and per day in 2009 to 0.056 DDD per 1 000 inhabitants and per day in 2013. A significant increase was also observed for five individual countries (Denmark, Ireland, Norway, Slovenia and Sweden). None of the countries reporting comparable data for all years during the period 2009–2013 showed a significant decreasing trend.

Trends in consumption of polymyxins for the period 2009–2013 are presented in Table 5. The EU/EEA population-weighted mean consumption of polymyxins significantly increased from 0.008 DDD per 1 000 inhabitants and per day in 2009 to 0.014 DDD per 1 000 inhabitants and per day in 2013. A significant increase was also observed for two individual countries (Ireland and Norway). None of the countries reporting comparable data for all years during 2009–2013 showed a significant decreasing trend.

Table 4. Trends in consumption of carbapenems in EU/EEA countries, 2009–2013 (expressed as DDD per 1 000 inhabitants and per day)

Country	2009	2010	2011	2012	2013	Trends in consumption of carbapenems, 2009–2013	Average annual change 2009–2013	Statistical significance
Bulgaria	0.011	0.010	0.013	0.013	0.014		<0.001	n.s.
Netherlands (a)		0.015	0.018	0.019	0.020			n.a.
Latvia	0.011	0.048	0.029	0.019	0.022		-0.001	n.s.
Lithuania (a)				0.026	0.026			n.a.
Estonia	0.020	0.027	0.036	0.036	0.033		0.003	n.s.
France	0.026	0.027	0.030	0.021	0.033		0.001	n.s.
Slovakia (a)	0.014			0.027	0.034			n.a.
Norway	0.042	0.044	0.044	0.045	0.046		0.001	significant
EU/EEA	0.043	0.050	0.049	0.054	0.056		0.003	significant
Sweden	0.049	0.052	0.052	0.054	0.056		0.001	significant
Croatia (a)				0.065	0.060			n.a.
Slovenia	0.061	0.067	0.078	0.074	0.061		-0.062	significant
Belgium (a)		0.068	0.079	0.062	0.062			n.a.
Malta	0.079	0.077	0.105	0.052	0.066		-0.005	n.s.
Italy (a)		0.069	0.039	0.073	0.076			n.a.
Denmark	0.052	0.056	0.060	0.063	0.087		0.008	significant
Ireland	0.042	0.058	0.057	0.062	0.088		0.009	significant
Finland (b)	0.085	0.081	0.094	0.074	0.088		<0.001	n.s.
Luxembourg (a)		0.096	0.087	0.100	0.094			n.a.
Greece (a)	0.124		0.130	0.132	0.134			n.a.
Hungary (a)	0.022	0.027						n.a.
Portugal (a) (c)	0.134	0.141	0.140	0.143				n.a.
Romania (a)	0.022	0.005						n.a.

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's 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 2009–2013.

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

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

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, 2009–2013 (expressed as DDD per 1 000 inhabitants and per day)

Country	2009	2010	2011	2012	2013	Trends in consumption of polymyxins, 2009–2013	Average annual change 2009–2013	Statistical significance
Bulgaria	0	0	0	0	0			n.a.
Estonia	<0.001	<0.001	<0.001	0.002	0		<0.001	n.s.
Finland (b)	0	0	0	0	0			n.a.
Lithuania (a)				0	0			n.a.
Norway	0.0002	0.0001	0.0004	0.0006	0.0006		<0.001	significant
Sweden	0.001	0.001	0.001	0.001	0.001		0.001	n.s.
Denmark	0.002	0.002	0.002	0.002	0.002		<0.001	n.s.
Latvia (a)				0.003	0.002		0.001	n.s.
Slovenia	0.001	0.001	0.002	0.004	0.003		0.001	n.s.
Netherlands (a)		0.005	0.003	0.002	0.003			n.a.
Croatia (a)				0.029	0.003			n.a.
Luxembourg (a)		0.005	0.005	0.005	0.006			n.a.
Malta	0.002	0.026	0.004	0.002	0.006		-0.002	n.s.
Belgium (a)		0.008	0.009	0.006	0.008			n.a.
France	0.008	0.008	0.008	0.008	0.008		<0.001	n.s.
EU/EEA	0.008	0.008	0.011	0.014	0.014		0.002	significant
Ireland	0.011	0.014	0.014	0.015	0.015		0.001	significant
Slovakia(a)	0.019			0.020	0.023			n.a.
Italy (a)		0.012	0.011	0.019	0.023			n.a.
Greece (a)	0.048		0.078	0.085	0.084			n.a.
Hungary (a)	0.001	0.003						n.a.
Portugal (a) (c)		0.013	0.019	0.019				n.a.
Romania (a)	0.008	0.003						n.a.

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's 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 2009–2013.

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

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

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

n.s.: not significant.

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. Additionally, it has been shown that antibiotic pressure due to high antimicrobial use in hospitals can be a risk factor for the acquisition of multidrug-resistant bacteria.

The spread of multidrug-resistant bacteria in healthcare facilities has become a public health threat. The level of threat depends on the frequency with which multidrug-resistant occur bacteria in the community and subsequently in healthcare systems. The transmission of multidrug-resistant bacteria between patients in hospitals must be reduced and possibly prevented by appropriate infection control measures.

Patients receiving antibiotics are more likely to be colonised with multi-drug resistant bacteria and therefore at greater risk of developing subsequent infections with these bacteria than patients who do not receive antibiotics.

Carbapenems are a last-line group of antibiotics and are mainly used in hospitals for the treatment of patients with confirmed or suspected infection involving a multidrug-resistant bacterium. However, misuse and overuse of carbapenems will contribute to the selection of carbapenem-resistant bacteria. Indeed, prior use of a carbapenem antibiotic is a risk factor for subsequent infection with a carbapenem-resistant bacterium such as [carbapenemase-producing *Enterobacteriaceae* or 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.

Reporting of hospital antibiotic consumption data to ESAC-Net should be consolidated and this is the next challenge for surveillance – to inform and evaluate interventions to reduce antimicrobial resistance. ECDC is developing an EU-wide protocol for collecting data at hospital level, and by using hospital-related activity indicators as denominators (e.g. the number of admitted patients rather than the overall population of a country). Such developments should facilitate the linking of antibiotic consumption data from ESAC-Net with antibiotic resistance data from the [European Antimicrobial Resistance Surveillance Network \(EARS-Net\)](#).